

FOURTH FIVE-YEAR REVIEW REPORT
FOR
ADVANCED MICRO DEVICES, INC. (BUILDING 915) SUPERFUND SITE
SANTA CLARA COUNTY, CALIFORNIA



PREPARED BY

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Executive Summary

This is the fourth Five-Year Review (FYR) for the Advanced Micro Devices, Inc. (AMD) Building 915 Superfund Site (AMD 915 Site; Site) located in Sunnyvale, California. The purpose of this FYR is to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this FYR was the previous FYR signed on 30 September 2009.

Advanced Micro Devices, Inc. constructed a semiconductor fabrication and research and development facility at the Site in 1974 and operated it until 2003. During the 1970s, trichloroethene (TCE) and other industrial solvents were used for cleaning and degreasing. Acids, caustics, and other chemicals were also used at the facility. Hazardous wastes were generated and stored in underground storage tanks (USTs), two of which leaked and caused groundwater and soil contamination.

The primary contaminants of concern (COCs) in groundwater at the AMD 915 Site are TCE and cis-1,2-dichloroethene (cis-1,2-DCE). The primary on-site source for this contamination appears to have been a leak from one of three tanks comprising the Pad C acid neutralization system (ANS). Other COCs in groundwater and soil include 1,2,4-trichlorobenzene and xylenes, which were caused by a leak from the 712-D photoresist stripper tank.

The soil contamination was addressed by AMD in the early 1980s. Two interim remedial actions for soil were completed between 1981 and 1982. The first action included the removal of a waste solvent tank and the photoresist stripper tank; the second action consisted of the removal of the ANS from the Pad C area north of the AMD 915 facility. Following completion of the remedial investigation (RI) in 1990, it was determined that the interim remedial actions for soil had been successful. Consequently, no further remedial action of soil was determined to be necessary.

The groundwater contamination was addressed in the 1991 Final Site Cleanup Requirements (Final SCR) and the 1991 Record of Decision (ROD). The remedy chosen for the Site in the Final SCR was the interim remedial system in place at the time. The remedy consisted of the following:

- Groundwater extraction from eight on-site wells (four A aquifer wells, two B1 aquifer wells, and two B2 aquifer wells)
- Air stripping to remove volatile organic compounds (VOCs) from groundwater (with stripped VOCs emitted directly to the air under an existing permit)
- Carbon adsorption to further polish air stripper effluent
- On-site reuse of treated water and discharge of excess treated water to the storm drain under permit

The ROD added the following components to the remedy:

- Periodic groundwater monitoring to verify plume containment, to determine current plume boundaries, and to follow the decrease in VOC concentrations as the cleanup progresses
- Institutional controls in the form of a deed restriction to limit access to site groundwater until the cleanup standards have been met

Groundwater at the Site is described by zones, which are known from shallowest to deepest as the A-, B1, B2-, and B3-zones. These zones occur in the shallow/upper aquifers. Deeper aquifers exist below the B3-

zone. The highest concentrations of VOCs exist in the A- and B1-zones. COCs are also present in elevated concentrations in the B2-zone.

In addition to the on-site sources of groundwater contamination, three upgradient (off-site) sources exist to the south of the AMD 915 Site: 1) the former TRW Microwave site; 2) the former Philips Semiconductors site; and 3) the former AMD 901/902 site. Other off-site sources of regional VOC contamination that have been documented recently include the Mohawk plume, which is composed predominantly of cis-1,2-DCE and located south of the Site. Because upgradient (off-site) sources appear to cause ongoing TCE and cis-1,2-DCE contamination of groundwater beneath the AMD 915 Site, the progress of past and ongoing remediation efforts have been substantially compromised.

The current groundwater and extraction treatment (GWET) system, as modified in 2012 with Regional Water Quality Control Board (RWQCB) approval, consists only of granular activated carbon (GAC) treatment. Cleanup standards (i.e., the more stringent of the Federal or State Maximum Contaminant Levels (MCLs)) are not being achieved in the groundwater due to off-site contamination migrating onto the Site. Recent data show that TCE and cis-1,2-DCE exceed cleanup standards in groundwater across much of the Site. Recently, vinyl chloride and 1,2,4-trichlorobenzene have been detected in select wells above their respective cleanup standards. Containment of COCs on the Site, however, appears to be largely effective due to operation of the GWET system.

The use of groundwater from the shallow aquifers (i.e., the A-, B1-, and B2-zone aquifers) as a source of drinking water is prohibited by the 1992 restrictive covenant (an institutional control). However, a new environmental restrictive covenant that complies with California Civil Code section 1471 has not yet been implemented as previously recommended. AMD no longer owns the Site and does not have the legal right to record a new deed restriction on the Site property. The current property owner (Watt) submitted a revised deed restriction to the California Regional Water Quality Control Board (RWQCB); it is expected that the revised deed restriction will be recorded shortly.

The groundwater cleanup standards and toxicity factors for several COCs have changed since the Final SCR and ROD. These changes do not affect the protectiveness of the remedy because no one is drinking on-site groundwater and the extraction system appears to be containing contaminants on the Site. On-site and off-site land use has not changed in the last five years, but it may change in the near future because the AMD 915 property was recently purchased by Watt.

The vapor intrusion pathway was not evaluated at the time of the ROD. However, the third FYR recommended evaluating this pathway because it might pose a greater risk to human health than was assumed when the ROD was prepared.

Vapor intrusion was evaluated in August 2011 and then re-evaluated in February 2014 with results indicating that contaminants in the indoor air related to vapor intrusion at the occupied 915 building do not exceed health-protective screening levels. The indoor air sampling conducted did not include analysis of benzene and chloroform, however, which were measured above screening levels in soil gas around the 915 building in subsequent investigations. It is noted that chloroform, a by-product of drinking water disinfection, is often detected in the indoor air samples of buildings served by public water utilities. Also, benzene is not detected in the groundwater beneath the Site.

The remedy at the AMD 915 Site currently protects human health and the environment because the restrictive covenant prohibits the use of site groundwater for drinking water purposes, and indoor air concentrations of volatile contaminants have been below protective levels. However, in order to protective in the long term, the following actions need to be taken: 1) record a new environmental restrictive covenant for the property that is consistent with current California law, 2) establish a broader strategy for groundwater restoration for the site taking into account the upgradient sites and 3) an Explanation of Significant Differences should be issued to set new clean up goals for the chemicals considering the new MCLs.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Advanced Micro Devices, Inc. (Building 915)		
EPA ID: CAT080034234		
Region: 9	State: CA	City/County: Sunnyvale/Santa Clara
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: State If "Other Federal Agency" was selected above, enter Agency name: Click here to enter text.		
Author name (Federal or State Project Manager): Melanie Morash; Max Shahbazian		
Author affiliation: U.S. Environmental Protection Agency Region 9; San Francisco Bay Regional Water Quality Control Board		
Review period: 08/27/2013 – 09/30/2014		
Date of site inspection: 10/24/2013		
Type of review: Policy		
Review number: 4		
Triggering action date: 09/30/2009		
Due date (five years after triggering action date): 09/30/2014		

Five-Year Review Summary Form (continued)

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): Groundwater	Issue Category: Remedy Performance			
	Issue: The groundwater extraction and treatment system may not be able to restore the groundwater to its beneficial use as a potential source of drinking water due to VOCs from upgradient (off-site) sites migrating onto the AMD915 Site.			
	Recommendation: Establish a broader strategy for groundwater restoration for the AMD 915 upgradient sites.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	EPA	EPA/State	09/2019
OU(s): Groundwater	Issue Category: Institutional Controls			
	Issue: California Civil Code section 1471 has changed since the restrictive covenant was recorded.			
	Recommendation: A new restrictive covenant that complies with California Civil Code section 1471 should be recorded.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	EPA	EPA/State	12/2016
OU(s): Groundwater	Issue Category: Remedy Performance			
	Issue: A State MCL for hexavalent chromium has recently been established and the MCLs for chloroform, ethylbenzene and 1,2,4-trichlorobenzene has changed.			
	Recommendation: An Explanation of Significant Differences should be issued to set new clean up goals for the chemicals considering the new MCLs.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	EPA	EPA	09/2019
Sitewide Protectiveness Statement (if applicable)				
<i>Protectiveness Determination:</i> Short-term Protective			<i>Addendum Due Date (if applicable):</i> Click here to enter date.	
<i>Protectiveness Statement:</i> The remedy at the AMD 915 Site currently protects human health and the environment because the restrictive covenant prohibits the use of site groundwater for drinking water purposes, and indoor air concentrations of volatile contaminants have been below protective levels. However, in order to protective in the long term, the following actions need to be taken: 1) record a new environmental restrictive covenant for the property that is consistent with current California law, 2) establish a broader strategy for groundwater restoration for the site taking into account the upgradient sites and 3) an Explanation of Significant Differences should be issued to set new clean up goals for the chemicals considering the new MCLs.				

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List of Abbreviations

AMD	Advanced Micro Devices, Inc.
AMD 915	Advanced Micro Devices, Inc. (Building 915)
ANS	acid neutralization system
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
cis-1,2-DCE	cis-1,2-dichloroethene
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
DDE	dichlorodiphenyldichloroethene
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
ESL	Environmental Screening Level
FRAP	Final Remedial Action Plan
Freon 11	trichlorofluoromethane
Freon 113	1,1,2-trichloro-1,2,2-trifluoroethane
FS	Feasibility Study
FYR	Five-Year Review
GAC	granular activated carbon
gpm	gallons per minute
GWET	groundwater extraction and treatment
HVAC	heating, ventilation, and air conditioning
lb	pound
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
µg/L	micrograms per liter
µg/m ³	micrograms per cubic meter
NCP	National Contingency Plan
ND	non-detect
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Regional Screening Level
RWQCB	Regional Water Quality Control Board
SCR	Site Cleanup Requirements
SDC	Submicron Development Center

State	State of California
TCE	trichloroethene
trans-1,2-DCE	trans-1,2-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
USACE	United States Army Corps of Engineers
USC	United States Code
UST	underground storage tank
VOC	volatile organic compound
VISL	Vapor Intrusion Screening Level
Watt	Watt Investments of Sunnyvale, LLC
WDR	waste discharge requirement

Fourth Five-Year Review Report

for

Advanced Micro Devices, Inc. (Building 915)

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA 121 states:

“If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.”

EPA interpreted this requirement further in the NCP, 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which states:

“If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.”

The U.S. Army Corps of Engineers (USACE), Seattle District, conducted the FYR and prepared this FYR report for the Advanced Micro Devices, Inc. (AMD) Building 915 Superfund Site (AMD 915 Site; Site) in Sunnyvale, Santa Clara County, California. The State of California (State) is the lead agency for developing and implementing the remedy for the AMD 915 Site.

This is the fourth FYR for the AMD 915 Site. The triggering action for this policy review is the previous FYR signed on 30 September 2009. The FYR is required because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

The AMD 915 Site has been designated as a single Operable Unit (OU). Groundwater contamination is the primary concern at the site, and a groundwater extraction and treatment (GWET) system is operating to clean up the contaminated groundwater. Soil contamination was determined to be sufficiently cleaned up with initial response actions in the early 1980s, prior to issuance of the 1991 Final Site Cleanup Requirements (Final SCR; RWQCB 1991) and the 1991 Record of Decision (ROD; EPA 1991).

2. Site Chronology

Table 1 lists important events and dates for the AMD 915 Site.

Table 1. Chronology of Site Events

Event	Date
AMD began semiconductor fabrication at 915 DeGuigne Drive	1974
AMD removed leaking underground storage tanks (USTs)	1981-1982
AMD discovered soil and groundwater contamination at the site	1982
AMD began groundwater extraction and treatment	1982
Regional Water Board issued Waste Discharge Requirements (WDR) Order	April 1985
Regional Water Board adopted Site Cleanup Requirements Order	May 1989
Baseline Public Health Evaluation completed for Site	1990
EPA formally added the AMD Site to the National Priorities List (NPL)	September 1990
Regional Water Board and EPA approved Final Remedial Investigation (RI)/Feasibility Study (FS) and Final Remedial Action Plan (FRAP) for AMD and adjacent TRW Microwave and Philips Sites	June 1991
Regional Water Board adopted Order No. 91-101, the Final Site Cleanup Requirements (Final SCR) for the Site	June 1991
EPA issued the ROD for the Site	August 1991
AMD stopped industrial operations at the Site	1992
Regional Water Quality Control Board (RWQCB) and EPA completed the first FYR	September 1999
RWQCB and EPA completed the second FYR	September 2004
AMD shut down extraction well EW-3 because it was pumping at a very low rate, and volatile organic compound (VOC) concentrations ranged from non-detect (ND) to less than 5 micrograms per liter (µg/L)	2006
AMD conducted investigations to better delineate the distribution of VOCs in the subsurface	2007
RWQCB and EPA completed the third FYR	September 2009
AMD conducted indoor air sampling and analysis of vapor intrusion pathway	August 2011
Limited Phase II Environmental Site Assessment conducted for prospective purchaser	November 2011
AMD assumed responsibility for operation and maintenance of the treatment system (previously operated and maintained by Philips Semiconductor)	January 2012
Change from air stripping with granular activated carbon (GAC) polishing to just GAC vessels as primary VOC treatment	May 2012
Effluent exceedance of cis-1,2-DCE	November 2012
Additional GAC vessel installed to address effluent exceedance	January 2013
Subsurface investigation conducted on the eastern portion of the property (east of the 915 building) for the City of Sunnyvale	April 2013
Phase II Environmental Site Assessment conducted for prospective purchaser	November 2013
EPA Region 9 issued letter to RWQCB describing guidelines and supplemental information needed for vapor intrusion evaluations at the South Bay NPL sites (AMD 915 is one of the South Bay NPL sites)	December 2013
AMD submits Vapor Intrusion Evaluation Report to comply with EPA Region 9's December 2013 letter, which is based on previous investigations at the site	February 2014

3. Background

3.1. *Physical Characteristics*

The AMD 915 Site comprises approximately 25 acres of relatively flat land at an average elevation of approximately 40 feet above sea level, approximately 4 miles south of the southern end of San Francisco Bay in Sunnyvale, California. Sunnyvale has a population of approximately 120,000, and is part of the San Francisco Bay Metropolitan Region, which has a total population of about six million. Most buildings in the vicinity are low-rise developments containing office space and research and development facilities.

Two large, low-rise buildings connected by a hallway exist at the Site: the former AMD 915 main building (the larger building with an east-west orientation) and the former AMD Submicron Development Center (a smaller building on the southwest portion of the Site). The former AMD Submicron Development Center is currently unoccupied. These buildings are shown in Figure 1 and Figure 2. The east and west portions of the main building have basement dewatering systems that consist of a gravel layer drained by a network of 4- inch perforated PVC pipes terminating at nine basement dewatering sumps (sumps #1 - #9). The dewatering system is approximately 14 feet below ground surface (bgs). Figure 3 shows the location of on-site monitoring wells, on-site extraction wells, and nearby off-site wells.



Figure 1. Location Map for the AMD 915 Superfund Site

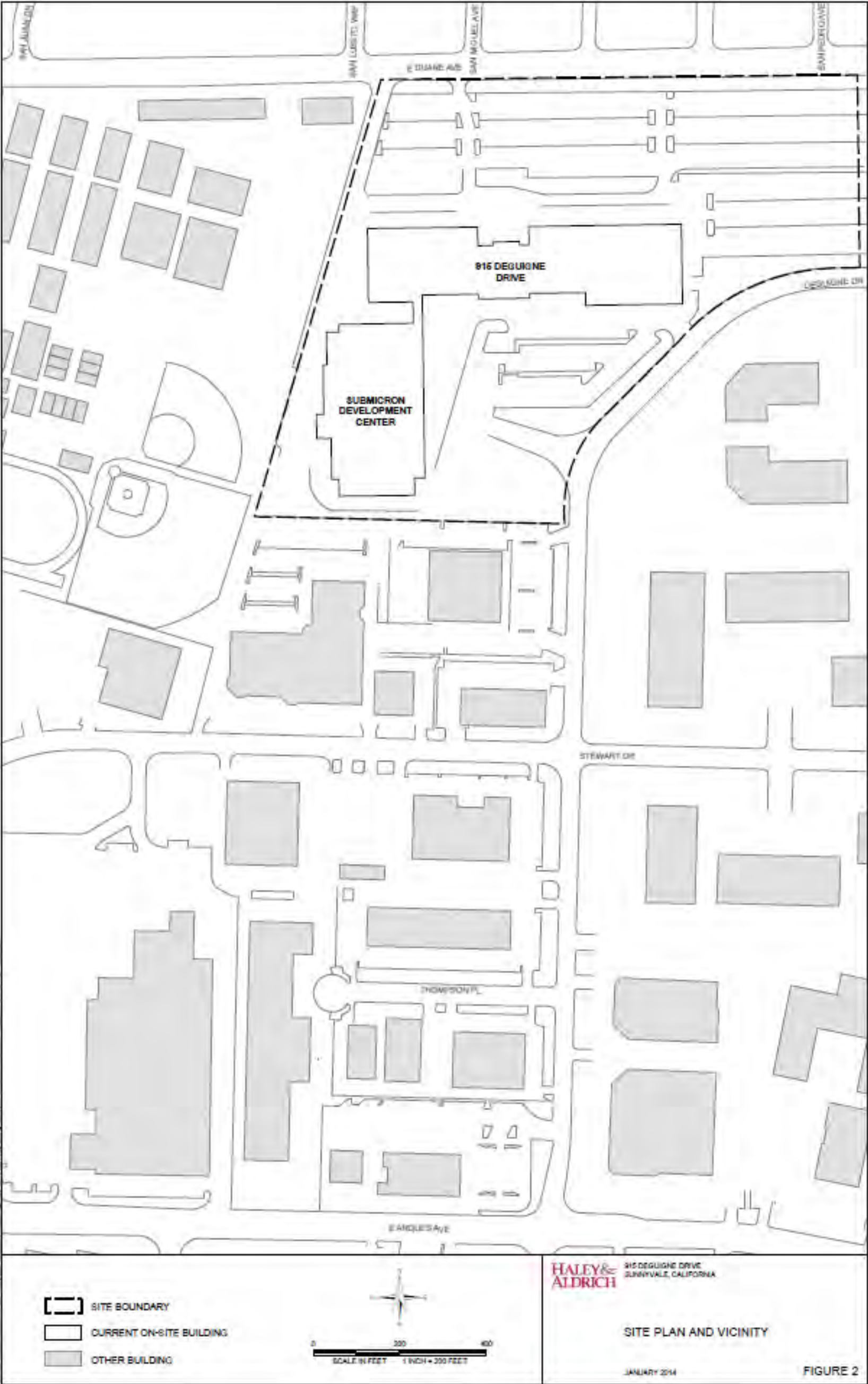


Figure 2. Site Plan and Vicinity

3.2. Hydrology

The AMD 915 Site is located in the Santa Clara Valley, a structural basin filled with marine and alluvial sediments. The coarser deposits are probably the result of deposition in or near stream channels that drain the highlands surrounding the basin. Finer-grained deposits result from a variety of conditions with the eventual result of a heterogeneous sequence of interbedded sands, silts, and clays. The natural groundwater flow direction beneath the Site is to the north toward San Francisco Bay. Municipal water supply wells tap an extensive, deep, regional, confined aquifer that lies generally greater than 200 to 300 feet bgs. A thick, relatively impermeable aquitard separates this deep aquifer from a complex series of laterally discontinuous aquifers and aquitards that can extend to within a few feet of the ground surface.

Four distinct water-bearing zones in the upper 100 feet bgs (the upper aquifer) of this Site have been characterized, from shallowest to deepest, as the A-, B1-, B2-, and B3-zones. The A-zone is approximately 7 to 20 feet bgs; the B1-zone is approximately 20 to 35 feet bgs; the depth to B2-zone is highly variable ranging from 38 to 65 feet bgs; and the B3-zone is approximately 65 to 90 feet bgs. These transmissive hydro-geologic units are generally composed of coarse-grained sand or sandy gravel. Groundwater contamination, which consists of VOCs, extends down to approximately 68 feet. The highest concentrations of VOCs exist in the A-zone and B1-zone. VOCs are also present in elevated concentrations in the B2-zone. Deeper aquifers (i.e., below 100 feet) that are currently being used as drinking water sources have not been impacted by chemicals at this Site. The upper aquifer zones are separated from the deeper aquifers by sedimentary soils with variable thicknesses ranging in type from clay to silty sand. There is some degree of hydraulic connection among the upper aquifer zones (i.e., in the upper 100 feet bgs) due to discontinuities in the various lithologies.

3.3. Land and Resource Use

Prior to 1974, the land use at the Site was agricultural. In 1974, AMD constructed a semiconductor fabrication and research and development facility at the Site and operated it until 2003, when AMD transferred ownership of the property to Spansion LLC, a joint venture of Fujitsu and AMD. In December 2005, Spansion LLC became Spansion, Inc. (Spansion), a corporation separate from AMD specializing in flash memory devices. The property was subsequently purchased by Watt Investments of Sunnyvale, LLC (Watt) in January 2014.

The Site has been used as a semiconductor fabrication facility from 1974 to the present. During the 1970s, TCE and other industrial solvents were used for cleaning and degreasing. Acids, caustics, and other chemicals were also used at the facility. Hazardous wastes were generated and stored in underground storage tanks (USTs), two of which were found to have leaked and caused groundwater contamination.

Single family residences occupy the area north of the Site between Duane Avenue and Highway 101; outdoor recreational space (Fair Oaks Park) and City of Sunnyvale School District property are to the west; and light industrial/commercial properties lie to the south and east of the Site. The Site is located in a light industrial and commercial area dominated by the electronics industry known as Silicon Valley. Silicon Valley is part of the larger Santa Clara Valley groundwater basin. Groundwater from this basin provides up to 50% of the municipal drinking water for over 1.5 million residents of the Santa Clara Valley.

The Site is currently zoned for industrial use, but this zoning may change in the future. The Limited Phase II Environmental Site Assessment conducted in 2011 (Treadwell and Rollo 2012) suggests that the site was being evaluated for re-zoning from commercial/industrial to residential and mixed-use commercial/residential. Furthermore, the April 2013 subsurface investigation for the City of Sunnyvale (Ground Zero Analysis, Inc. 2013) suggests that, as part of redevelopment plans, the project proponent intended to dedicate approximately 5.8 acres to the City of Sunnyvale for a public park. The current owner may build a small private park on the property for future residents of apartments and condos.

3.4. History of Contamination

Vaulted and un-vaulted underground storage tanks (USTs) with capacities from 1,500 to 3,000 gallons were installed at the Site between 1974 and 1982 to support AMD's semiconductor fabrication processes. Below-grade acid neutralization systems (ANSs) with capacities ranging from 1,500 to 4,700 gallons were installed in 1974 and 1980 and upgraded in 1982. A UST containing the 712-D photoresist stripper was installed in 1977.

Chemicals historically used by AMD included solvents and corrosives. Solvent waste generated between 1980 and 1989 included primarily n-butyl acetate, xylenes (stored in underground tanks), and Freon wastes (stored in drums at designated areas). Of the 21 tanks documented at the Site, two of these appear to have leaked. The primary on-site source for VOCs in groundwater appears to have been a TCE leak from one of three tanks comprising the Pad C ANS (see dashed line in Figure 3). The 712-D photoresist stripper tank also leaked, contaminating nearby soils and groundwater with 1,2,4-trichlorobenzene and xylenes.

In addition to the groundwater VOC contamination described above, three upgradient (off-site) VOC sources exist to the south of the AMD 915 Site: 1) the former TRW Microwave site at 825 Stewart Drive; 2) the former Philips Semiconductors site at 811 East Arques; and 3) the former AMD 901/902 Thompson Place site. The AMD sites and the TRW Microwave site are Superfund sites; the Philips site is regulated under the Resource Conservation and Recovery Act (RCRA). Because it is difficult to identify discrete sources of VOCs in the AMD 915 Site groundwater and downgradient groundwater attributable to these three sites, a relatively large area down-gradient of these four sites known as the "Offsite Operable Unit (OU)" was mapped in the 1980s as a single commingled VOC plume composed chiefly of dissolved TCE. The commingled plume from the Philips, AMD, and TRW sites extends into the A-zone and B1-zone aquifers, is approximately 4,000 feet long, and extends northward beyond Highway 101. Philips is operating its own system on the Offsite OU to contain the bulk of the plume.

The AMD 915 Site was listed on the National Priorities List (NPL) in September 1990. A ROD was issued in 1991. The primary COCs at the AMD 915 Site described in the Final SCR and ROD are the following VOCs: benzene; chloroform; 1,1-DCA; cis-1,2-DCE; trans-1,2-DCE; 1,1-DCE; ethylbenzene; PCE; toluene; 1,1,1-TCA; TCE; Freon 113; and vinyl chloride. Contaminants are present in the upper aquifer zones and in basement sump water.

Other sources of regional VOC contamination that have been documented more recently include the Mohawk plume, which is composed predominantly of cis-1,2-DCE and located south of the Site (Geomatrix 2008). Because upgradient (off-site) sources appear to cause ongoing TCE and cis-1,2-DCE

contamination in groundwater beneath the AMD 915 Site, the progress of past and ongoing remediation efforts has been substantially compromised. In addition, groundwater pumped from the Site's basement dewatering sumps will likely require on-site treatment prior to discharge or re-use for many years if off-site sources are not addressed.

3.5. Initial Response

Two interim remedial actions for soil were completed in 1981 and 1982 by AMD. The first action involved the removal of a waste solvent tank and the photoresist stripper tank in June 1981. This excavation resulted in the removal of approximately 1,500 cubic yards of soil, but the soil was not analyzed for VOCs at that time. Additional investigation of the area in July 1990 included VOC analysis and indicated that the original action had been successful because no remaining soil exceeded 1 part per million (ppm) of VOCs.

The second action included the removal of the ANS from the Pad C area north of the AMD 915 facility. The ANS and approximately 5,500 cubic yards of soil were removed from December 1981 through January 1982. The excavation depth ranged from approximately 15 to 28 feet bgs, and the excavation was backfilled with sand-cement slurry to a depth of approximately 5 feet bgs. Excavated materials were disposed of at an off-site commercial disposal facility. The shoring for the excavation remained in place. In July of 1990, additional data collection to investigate remaining potential sources of soil contamination was completed as part of the final remedial investigation (RI) study. The only analytes detected in the soil samples at that time were 1,2,4-trichlorobenzene and 1,2,3-trichlorobenzene. These analytes were present at levels below 1 part per million (ppm), which represented insignificant soil contamination. Thus, following completion of the (RI), it was determined that the interim remedial actions for soil had been successful.

Groundwater remediation began with extraction of the groundwater from four sumps that were already in place when the 915 building was constructed in 1974. In 1982, five groundwater extraction wells were installed, with four wells extracting water from the A-zone and B1-zone aquifers and one well extracting water from the A-zone, B1-zone, and B2-zone aquifers. In 1984, four additional extraction wells were installed. These wells were combined with the two best-producing wells that had been installed in 1982, for a total of six extraction wells. The intent of the changes was to improve the control of contamination migrating off the Site. Extracted groundwater was piped to a groundwater treatment system consisting of two air strippers (one active and one reserve) and aqueous-phase activated carbon adsorption units. This treatment system was completed in January 1984. A seventh extraction well was installed in the B2-zone aquifer in 1985. An eighth extraction well was added in the B2-zone aquifer in 1988.

The treatment system had consistently removed 90 to 99 percent of VOCs from groundwater, and by the time the Final SCR was issued in 1991, approximately 30% of the treated water was being reused as industrial process water or cooling water prior to release to the sanitary sewer. The remaining treated water was discharged to a storm-sewer tributary of the Calabazas Creek under NPDES permit number CA0028797.

3.6. Basis for Taking Action

The primary COCs for the AMD 915 Site are VOCs in groundwater. Groundwater in the Santa Clara Valley basin provides up to 50% of the municipal drinking water for over 1.5 million residents in the valley. The presence of these contaminants in the groundwater represented a potential threat to the valuable drinking water source and provided the basis for taking action under CERCLA. Trichloroethene, cis-1,2-DCE, and other COCs were considered possible and/or probable human carcinogens. The primary threat to human health was posed by ingestion of groundwater.

4. Remedial Actions

4.1. Remedy Selection

The ROD established the following remedial action objectives (RAOs) for the AMD 915 Site:

- Prevention of the near-term and future exposure of human receptors to contaminated groundwater;
- Restoration of the contaminated groundwater for future use as a potential source of drinking water;
- Control of contaminant migration; and
- Monitoring of contaminant concentrations in groundwater to observe the control of contaminant migration and the progress of cleanup.

The COCs listed in the Final SCR and ROD included the following: benzene; trivalent chromium; hexavalent chromium; chloroform; dichlorodifluoromethane; 1,1-dichloroethane; 1,1-dichloroethene; cis-1,2-DCE; trans-1,2-DCE; ethylbenzene; Freon 113; tetrachloroethene; toluene; 1,2,4-trichlorobenzene; 1,1,1-trichloroethane; trichloroethene; trichlorofluoromethane; and xylenes (total). The Final SCR and the ROD both included the following requirement:

The cleanup standards must meet all applicable, relevant, and appropriate requirements (ARARs) and be protective of human health and the environment.

The cleanup standards are the more stringent of the federal or state maximum contaminant levels (MCLs) or non-zero maximum contaminant level goals (MCLGs). The compliance boundary includes all groundwater within the plume boundaries, all groundwater monitored in existing wells, and any contaminated groundwater identified by additional monitoring wells installed under RWQCB or EPA request for the purpose of monitoring potential vertical or horizontal migration of groundwater contaminant plumes currently located in the A-zone and B-zone aquifers.

The remedial action chosen for the site in the Final SCR was the interim remedial system in place at the time. The remedy consisted of the following:

- Groundwater extraction from eight on-site wells (four A aquifer wells, two B1 aquifer wells, and two B2 aquifer wells)
- Air stripping to remove VOCs from groundwater (with stripped VOCs emitted directly to the air under an existing permit)

- Carbon adsorption to further polish air stripper effluent
- On-site reuse of treated water and discharge of excess treated water to the storm drain under permit

The ROD added the following components to the remedy:

- Periodic groundwater monitoring to verify plume containment, to determine current plume boundaries, and to follow the decrease in VOC concentrations as the cleanup progresses
- Institutional controls in the form of a deed restriction to limit access to site groundwater until the cleanup standards have been met

4.2. *Remedy Implementation*

The groundwater extraction and treatment (GWET) system has been operating continuously at the Site since 1982. Prior to the third FYR, the GWET system consisted of the following major components:

- A network of nine on-site extraction wells, with EW-1 through EW-6 extracting water from the A- and B1-zones and EW-7 through EW-9 extracting water from the B2-zone. These wells extracted groundwater at a combined average flow ranging from approximately 48 to 71 gallons per minute (gpm). Extraction well EW-3 was shut down because it was pumping at a very low rate and VOC concentrations ranged from non-detect to less than 5 micrograms per liter ($\mu\text{g/L}$).
- Nine basement dewatering sumps, with the majority of flow pumped from basement sump BS-6, the easternmost sump. Since BS-6 has been monitored, it has pumped at an average extraction rate ranging from 3.2 to 11 gpm. In 2013, the total flow extracted from the dewatering sumps was greater than 20 gpm, with approximately 8.8 gpm from BS-6 and 11.5 gpm from the other eight sumps combined.
- An on-site treatment system for removing VOCs from extracted water. The treatment system included two packed-tower air strippers in parallel that discharged to a 40,000-pound (lb) GAC vessel.
- Off-site extraction wells operated by Philips Electronics as part of the Offsite OU that discharged groundwater to the AMD 915 on-site treatment system. Philips had a private agreement with AMD, however, this arrangement no longer exists, as described below.
- The NPDES discharge point consisting of the on-site storm drain, which ultimately discharges to Calabazas Creek.

The GWET system was operated and maintained by contractors of Philips Semiconductors, Inc. until January 2012. In December 2011, AMEC Environment and Infrastructure, Inc. (AMEC), AMD's contractor, submitted a permit transfer request to the RWQCB to transfer the operation and maintenance (including discharging) from Philips to AMD. In January 2012, the RWQCB approved the transfer, issuing Authorization to Discharge to AMD and rescinding it from Philips. AMD assumed responsibility for operation and maintenance of the treatment system in January 2012. While on-site groundwater continues to be remediated by the treatment system, no off-site groundwater (from off-site wells) has been treated by the on-site treatment system since 2011.

Prior to May 2012, the groundwater treatment system consisted of a 3,000-gallon feed tank, two air strippers, one 40,000-lb GAC vessel, and a 10,000-gallon tank for storing treated water prior to discharge or reuse. In order to optimize the system, AMEC submitted a system modification request on behalf of

AMD to the RWQCB. After the RWQCB approved the request in May 2012, AMEC modified the treatment system to use two 2,000-lb GAC vessels in series as the primary method of treating extracted groundwater, with the existing air strippers retained as a backup system. A scale inhibitor is added only when the air strippers are in use. A third 2,000-lb GAC vessel was added after cis-1,2-DCE in effluent samples exceeded the NPDES discharge limit of 5 µg/L in November 2012.

A restrictive covenant was prepared for the Site and recorded with the Santa Clara County Records Office on August 7, 1992 (Appendix F). The covenant prohibits the use of groundwater from the upper water-bearing aquifers (i.e., the A-, B1-, and B2-zone aquifers) as a source of drinking water. The deeper aquifers on the Site, which are used for drinking water, are not restricted by the covenant.

4.3. Operation and Maintenance (O&M)

Sampling activities for the GWET system are performed quarterly and monthly. Influent samples are taken once per quarter; mid-stream samples (between process units) and effluent samples are taken once per month. Samples are analyzed for VOCs by EPA Method 8260B. AMD submits quarterly reports to the State that describe the results of these analyses, the weekly and cumulative flow rates for the quarter, and the volume of water that is reused on-site. Routine system maintenance is performed regularly and other maintenance is performed as needed.

In November 2012, the effluent sample for cis-1,2-DCE (22 µg/L) and the confirmation effluent sample (33 µg/L) exceeded the NPDES discharge limit of 5 µg/L. AMD's contractor (AMEC) theorized that the decrease in performance of the primary GAC system was due to low-quality re-activated carbon and/or channeling due to improper carbon bed installation. A carbon change-out of both GAC vessels using virgin carbon was performed and an additional 2,000-lb GAC vessel was installed in series with the two existing GAC vessels to provide an extra layer of protection and control. The contractor (currently Haley and Aldrich) now uses only virgin carbon when carbon change-outs are performed. No exceedances have occurred in effluent samples since the changes were implemented.

Groundwater monitoring of 36 wells is conducted annually in accordance with the approved Sampling Plan (Advanced Micro Devices, Inc. 1999). Groundwater monitoring activities include collecting water-level measurements and obtaining samples by Teflon bailer to be analyzed for chlorinated VOCs, including 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113) and 1,2,4-trichlorobenzene (1,2,4-TCB), using EPA Method 8260B. Wells are purged prior to the collection of each sample until temperature, pH, and specific conductance are stable and a minimum of approximately three casing volumes are removed.

Annual O&M costs for the last five years average about \$144,000, and have increased substantially over the review period. An itemized breakdown of costs was not available at the time of this review.

Table 2. Annual Operations and Maintenance Costs

Year	Annual Cost
2009	\$63,000
2010	\$72,000
2011	\$144,000
2012	\$189,000
2013	\$253,000

5. Progress Since the Last Five-Year Review

5.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the third FYR for the AMD 915 Site stated the following:

A protectiveness determination of the remedy at Advanced Micro Devices (AMD) Superfund site at 915 DeGuigne Drive cannot be made at this time until further information is obtained concerning the potential for vapor intrusion. Recent changes in the methodology of assessing risk from VOCs requires further evaluation of the protectiveness of the remedy in terms of the potential vapor intrusion into buildings and to limit exposure to VOC vapors in indoor air. Further information will be obtained from collecting and analyzing soil gas and indoor air samples. It is expected that these actions will take approximately 18 months to complete, at which time a protectiveness determination will be made in an addendum to this Five Year Review.

Although the groundwater plume has been reduced and contained, current information indicates that the groundwater extraction and treatment system may not be able to restore the groundwater to its beneficial use as a potential drinking water supply due to migration of VOCs from up-gradient site cleanups in the region. In the short-term, the institutional controls are preventing exposure to, and the ingestion of, contaminated groundwater. For the remedy to be protective in the long term, the feasibility of alternative remedies or improvements to the existing system need to be evaluated to insure the long-term remedial objectives are achieved. Also, a new environmental restriction covenant consistent with current California law should be recorded to ensure long-term protectiveness.

The third FYR included three issues and recommendations. Each recommendation and the current status are discussed in the table below.

Table 3. Status of Recommendations from the 2009 FYR

Issues from 2009 FYR	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Mass removal efficiency of the GWET remedy is declining over time, and may not be capable of achieving groundwater cleanup standards.	Continue to assess the progress of groundwater extraction and treatment.	AMD	2014	System was changed to GAC in May 2012 as flow rates made air stripping less effective. Groundwater extraction and treatment still may not be capable of achieving groundwater cleanup standards.	2014, and ongoing

Issues from 2009 FYR	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
The vapor intrusion pathway has not been fully assessed at this Site.	Monitor soil gas and indoor air to assess vapor intrusion pathway	AMD	2011	A vapor intrusion investigation in August 2011 found that indoor air levels were below regional screening levels. An ESA in November 2011 found that soil gas levels of benzene and chloroform exceeded their RSLs outside the main facility. Benzene and chloroform were not analyzed for in indoor air in August 2011. Re-evaluation in 2014 indicated that TCE concentrations in indoor air were also below the short-term and long-term vapor intrusion screening levels.	2011, 2014
The existing covenant was recorded prior to adoption of California Civil Code section 1471.	A new environmental restrictive covenant should be recorded for the property consistent with current California law.	AMD	2010	The current property owner (Watt) submitted a revised deed restriction to the RWQCB in 2014. The property is currently changing ownership and building removed.	ongoing

5.2. Work Completed at the Site during this Five Year Review Period

The following work was completed at the AMD 915 Site during this FYR period:

- Annual groundwater monitoring
- Treatment system modifications
- An August 2011 indoor air investigation (AMEC 2011a)
- A November 2011 Limited Phase II Environmental Site Assessment for a prospective purchaser (Treadwell and Rollo 2012)
- An April 2013 subsurface investigation for the City of Sunnyvale (Ground Zero Analysis, Inc. 2013)
- A November 2013 Phase II Environmental Site Assessment for a prospective purchaser
- February 2014 re-evaluation of vapor intrusion (Haley and Aldrich 2014a) in response to December 2013 guidelines and supplemental information provided by EPA Region 9

6. Five-Year Review Process

6.1. Administrative Components

EPA Region 9 initiated this FYR in August 2013 and scheduled its completion for September 2014. The review team was led by Max Shahbazian, Engineering Geologist for the San Francisco Bay RWQCB

(State), and included EPA personnel Melanie Morash (Remedial Project Manager) and U.S. Army Corps of Engineers (USACE) Seattle District personnel Ellen Engberg (Geologist) and Aaron King (Environmental Engineer). On 27 August 2013, the State and EPA held a scoping call with the review team to discuss the Site and the status of the remedy protectiveness. A review schedule was established that consisted of the following actions:

- Community notification;
- Document review;
- Data collection and review;
- Site inspection;
- Local interviews; and
- FYR report development and review.

6.2. *Community Involvement*

On May 30, 2014, a public notice was published in the *Sunnyvale Sun* announcing the commencement of the Five-Year Review process for the AMD 915 Site, providing RWQCB and EPA's contact information, and inviting community participation. The press notice is available in Appendix B. No one contacted EPA as a result of this advertisement.

The FYR report will be made available to the public once it has been finalized. Copies of this document will be placed in the designated public repository: Regional Water Quality Control Board, San Francisco Bay Region, 2101 Webster Street, Suite 500, Oakland, CA 94612.

6.3. *Document Review*

This FYR included a review of relevant site-related documents including the ROD, remedial action reports, and recent monitoring data. A complete list of the documents reviewed can be found in Appendix A.

ARARs Review

Section 121 (d)(2)(A) of CERCLA specifies that Superfund remedial actions must meet any federal standards, requirements, criteria, or limitations that are determined to be legally Applicable or Relevant and Appropriate Requirements (ARARs). ARARs are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Chemical-specific ARARs identified in the Final SCR and ROD for groundwater at this Site and considered for this FYR for continued groundwater treatment and monitoring are listed in Table 4. The most stringent of the Federal MCLG (if not equal to zero), Federal maximum contaminant level (MCL), or State MCL serves as the cleanup standard for the COCs. California primary drinking water standards are the same as federal primary drinking standards except for the California standard (50 µg/L) for total chromium, which was more stringent than the federal standard (100 µg/L). The more stringent of the two concentrations mentioned above (California Standards) was determined to be the cleanup level for the Site. On May 28, 2014 the State of California amended Title 22 CCR §64413 to add hexavalent chromium to its regulated chemicals list, which became effective on July 1, 2014. The new MCL is 10

µg/L. The State MCL for total chromium remains unchanged. The Federal MCL for chloroform (value listed is for total trihalomethanes) was changed from 100 µg/L to 80 µg/L, with a non-zero MCLG of 70 µg/L for chloroform. The State MCL for ethylbenzene was changed from 680 µg/L to 700 µg/L in September 1994, and from 700 µg/L to 300 µg/L in June 2003. The State MCL for 1,2,4-trichlorobenzene was changed from 70 µg/L to 5 µg/L in June 2003. None of the ARAR changes occurred during the last five years.

Table 4. Summary of Chemical-specific ARAR Changes

Contaminants of Concern	1991 Final SCR Cleanup Standards (µg/L)	Current Federal MCL (µg/L)	Current State MCL (µg/L)	ARARs Changed?
Benzene	1	5	1	No
Chromium (III)	50	100 ^a	50 ^a	No
Chromium (VI)	50	100 ^a	10	More stringent
Chloroform	100	70 ^b	--	More stringent
1,1-dichloroethane (1,1-DCA)	5	--	5	No
1,1-dichloroethene (1,1-DCE)	6	7	6	No
cis-1,2-dichloroethene (cis-1,2-DCE)	6	70	6	No
trans-1,2-dichloroethene (trans-1,2-DCE)	10	100	10	No
Ethylbenzene	680	700	300	More stringent
Freon 113	1,200	--	1,200	No
Tetrachloroethene (PCE)	5	5	5	No
Toluene	150	1,000	150	No
1,2,4-trichlorobenzene	70	70	5	More stringent
1,1,1-trichloroethane (1,1,1-TCA)	200	200	200	No
Trichloroethene (TCE)	5	5	5	No
Trichlorofluoromethane (Freon 11)	150	--	150	No
Xylenes (total)	1,750	10,000	1,750	No
Vinyl chloride	0.5	2	0.5	No

Notes:

a. Currently, there is no Federal for chromium (III) or chromium (VI). The value listed is for total chromium.

b. Value listed is the Maximum Contaminant Level Goal (MCLG) for chloroform.

Federal laws, state laws, and regulations other than the chemical-specific ARARs listed in the Final SCR and/or ROD are described in Table 5. ARARs that are no longer pertinent because the remedy is in the post-construction completion phase are not included in the table. There have been no revisions to laws and regulations that affect the protectiveness of the remedy.

Table 5. Applicable or Relevant and Appropriate Requirements Evaluation

Requirement	Citation	Document	Description	Effect on Protectiveness	Comments	Amendment Date
Section 1412 of the Safe Drinking Water Act	42 United States Code (USC) §300G-1	ROD	Maximum contaminant level goals (MCLGs) that are set at levels above zero shall be attained for ground or surface waters that are current or potential sources of drinking water, where MCLGs are relevant and appropriate under the circumstances of the release based on the factors in 40 CFR §300.400(G)(2). The appropriate remedial goal for each indicator chemical in groundwater is the MCLG (if not equal to zero), the federal maximum contaminant level (MCL), or the State MCL, whichever is most stringent.	There has been no change to this law that affects protectiveness.		There has been no change to this law in the last five years.
California's "Statement of Policy with respect to Maintaining High Quality of Waters in California"	California's Resolution 68-16	Final SCR; ROD	The policy requires maintenance of existing water quality unless it is demonstrated that a change will benefit the people of the State, will not unreasonably affect present or potential uses, and will not result in water quality less than that prescribed by other State policies.	There has been no change to this law that affects protectiveness.	Cleanup of groundwater to below the MCL for COCs may not be achievable due to the technical difficulties in restoring aquifers by the removal of low concentrations of any VOC. Cleanup to MCL levels would protect the primary beneficial use of the groundwater as a potential source of drinking water. For these reasons, MCLs were accepted as concentrations that meet the intent of Resolution 68-16.	The resolution has not been changed in the last five years.

Requirement	Citation	Document	Description	Effect on Protectiveness	Comments	Amendment Date
National Pollutant Discharge Elimination System (NPDES)	40 CFR Part 122 and others	ROD	NPDES substantive permit requirements and/or RWQCB waste discharge requirements (WDRs) are potential ARARs for effluent discharges. The effluent limitations and monitoring requirements of an NPDES permit or WDRs legally apply to point source discharges such as those from a treatment system with an outfall to surface water or storm drains.	The changes in the regulations do not affect protectiveness. The VOC discharge limits have not changed since the ROD.	The RWQCB established effluent discharge limitations and permit requirements based on water quality standards set forth in the San Francisco Bay Regional Basin Plan or Best Available Technology Standards.	The NPDES regulations have been amended several times in the last five years.
Control of Air Emissions from Superfund Air Strippers at Superfund Ground Water Sites	EPA OSWER Directive 9355.0-28	ROD	The directive provides guidance on control of emissions from air strippers at Superfund sites.	There has been no change to this directive and it does not affect protectiveness.	The directive identifies a need to control VOC emissions from sites that exceed 15 pounds per day of total VOCs from air strippers and other vented extraction systems. Although this is a to-be-considered regulation, emissions from the vented remediation systems do not and will not exceed 15 pounds per day.	The directive has not been changed in the last five years.

Requirement	Citation	Document	Description	Effect on Protectiveness	Comments	Amendment Date
Air Stripping and Soil Vapor Extraction Operations	Bay Area Air Quality Management District (BAAQMD) Regulation 8, Rule 47	Final SCR; ROD	Individual air stripping and soil vapor extraction operations emitting benzene, vinyl chloride, tetrachloroethene, dichloromethane, and/or trichloroethene are required to control emissions by at least ninety percent by weight. Operations emitting less than one pound per day of these compounds are exempt from this requirement if they pass a district risk screen. Furthermore, individual air stripping and soil vapor extraction operations emitting greater than fifteen pound per day of organic compounds other than those listed above are required to control emissions by at least ninety percent by weight.	There has been no change to this law that affects protectiveness.		There has been no change to this law in the last five years.
Fish and Wildlife Coordination Act	16 USC §661-667e	ROD	Provides the authority for the involvement of the United States Fish and Wildlife Service in evaluating impacts to fish and wildlife when federal actions result in the control or modification of a natural stream or body of water.	There has been no change to this law that affects protectiveness.	The Fish and Wildlife Coordination Act is an applicable requirement for the locations adjacent to Calabazas Creek, Guadalupe Slough, and other tributary streams and marshes.	There has been no change to this law in the last five years.

Human Health Risk Assessment Review

The human health risk assessment was summarized in the AMD 915 Site ROD. The risk assessment identified the exposure pathways as incidental ingestion of soil during construction of future development, domestic use of groundwater (direct ingestion and inhalation), and off-gassed air from the air stripper. The domestic use of groundwater pathway was evaluated using two exposure scenarios: the maximum and the representative. The maximum exposure scenario assumed that an adult consumes 2 liters of contaminated groundwater every day for 30 years, while the representative exposure scenario assumed that an adult consumes 1.4 liters of contaminated groundwater every day for nine years. The risks associated with the exposure pathways are summarized in Table 6.

Table 6. Exposure Pathways and Risk Estimates Identified in the ROD

Exposure Scenario & Pathway	Risk Driver(s)	Risk Estimate
Incidental ingestion of soil (hypothetical future construction)	On-site workers	Hazard Index = 0.01 Cancer risk = 1.5×10^{-9}
Hypothetical future use of groundwater as domestic water supply: direct ingestion and inhalation during showering (and other use)	Residents	Maximum Exposure Hazard Index = 5 Cancer risk = 1.25×10^{-3} Representative Exposure: Cancer risk = 6.70×10^{-5}
Air emissions from air stripper	Releases to ambient air	Cancer risk = $<1 \times 10^{-5}$

The risk assessment was reviewed to identify any changes in exposure or toxicity that would impact protectiveness. The exposure pathways are still relevant, though the air strippers are now only used as a backup system. The vapor intrusion pathway was not evaluated at the time of the ROD. However, the third FYR recommended an evaluation of vapor intrusion at the site. This evaluation has since been completed, and the results are discussed below.

Vapor Intrusion: EPA's understanding of contaminant migration from soil gas and/or groundwater into buildings has evolved over the past few years, leading to the conclusion that vapor intrusion may pose a greater risk to human health than was assumed when the ROD was prepared. In 2002, EPA released vapor intrusion guidance titled, "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils" (EPA 2002) and in April 2013 EPA released a draft guidance document titled, "External Review Draft - Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (EPA 2013).

The potential for vapor intrusion is evaluated using a "multiple lines of evidence" approach. The primary volatile COCs at the AMD 915 Site described in the ROD and Final SCR are benzene; chloroform; 1,1-DCA; cis-1,2-DCE; trans-1,2-DCE; 1,1-DCE; ethylbenzene; PCE; toluene; 1,1,1-TCA; TCE; Freon 113; and vinyl chloride. Contaminants are present in the upper aquifer zones and in basement sump water.

The vapor intrusion pathway at the Site has been evaluated as part of several monitoring and sampling efforts, with increased frequency in the last five years:

- Annual groundwater monitoring has been performed since 1982

- An indoor air sampling program was completed at the main facility in August 2011 (AMEC 2011)
- A Limited Phase II Environmental Site Assessment (ESA) that included soil gas, groundwater, and soil sampling was completed on behalf of a prospective purchaser at the site and adjacent properties in November and December 2011 (Treadwell and Rollo 2012)
- A subsurface investigation that included soil gas and shallow soil sampling was completed on behalf of the City of Sunnyvale in April 2013 for an area to the east of the 915 DeGuigne building (Ground Zero Analysis, Inc. 2013)
- A Phase II ESA that included soil gas and soil sampling was completed on behalf of Watt in November 2013 (ENGEO 2013)

On December 3, 2013, EPA issued a letter to the RWCQB recommending that new guidelines and supplemental information be incorporated into existing and future vapor intrusion evaluation work plans for each of the South Bay NPL Sites, of which AMD 915 is one. The guidelines included the following:

- Interim TCE indoor air short-term response action levels and guidelines
- PCE indoor air screening levels for California sites
- Residential building sampling approach: multiple rounds of sampling including colder weather and crawlspace sampling
- Commercial building sampling approach: heating, ventilation, and air-conditioning (HVAC) system off and on, and pathway sampling
- Phased approach and clarification of vapor intrusion off-property study areas to include buildings overlying shallow groundwater TCE contamination at or above 5 µg/L

In February 2014, on behalf of AMD, Haley and Aldrich, Inc. submitted to the State an evaluation of prior vapor intrusion work completed at the site. The evaluation focused on recent A-zone groundwater monitoring data, the 2011 indoor air sampling event at the main facility, and the November 2011 Phase II ESA. Soil gas data from the November 2013 Phase II ESA (ENGEO 2013) were not available for the February 2014 evaluation (Haley and Aldrich 2014a), but were available for this review and are described below.

A-Zone Groundwater

Based on data from October 2010 to November 2013, TCE was detected above its vapor intrusion screening level (VISL) of 7.4 µg/L in A-zone groundwater monitoring wells 2-S, 8-S, 19-S, 31-S, 40-S, 41-S, and 49-S. Also, these seven wells were the only wells where TCE was detected above 5 µg/L. According to the guidelines in EPA Region 9's December 2013 letter (EPA 2013), detections above 5 µg/L define the extent of vapor evaluation areas for the South Bay NPL Sites. Vinyl chloride was also detected above its VISL of 2.5 µg/L in monitoring well 41-S. These wells with exceedances are located primarily on the western portion of the site, and they are generally either upgradient or cross-gradient of all known AMD 915 Site sources and operations. Exceeding groundwater VISLs, however, does not necessarily cause indoor air concentrations to be above protective levels.

August 2011 Indoor Air Sampling at the Main Facility (AMEC 2011a)

Indoor air sampling was performed in August 2011 to evaluate the potential for vapor intrusion at the main facility. Indoor air samples were not collected at the Submicron Development Center (SDC) building because the building was not occupied at the time of sampling (therefore, there were no potential exposures). Prior to collecting indoor air samples, a building survey and site walk was conducted with the RWQCB and EPA. Spansion was asked to turn off all HVAC units for the indoor air sampling program to provide a worst-case scenario of potential vapor intrusion. However, due to the presence of laboratories and other sensitive-use rooms, only one HVAC unit (AH-43) could be turned off. EPA personnel confirmed during the site walk that it would not be necessary to adjust the HVAC settings in laboratory areas that could be negatively affected by turning off their respective HVAC units.

Indoor air samples were collected during a 12-hour sampling period in August 2011. The sampling program included 5 ambient air samples, 10 breathing-zone samples, 6 preferential-pathway samples, and 2 duplicate samples. Table 7 presents the analytical results of the sampling, which have been compared to the EPA Region 9 regional screening levels (RSLs) for industrial air and the California modified indoor air screening levels (as noted in the table). None of the analyzed chemicals were detected above the screening levels and TCE was the only contaminant that was detected within an order of magnitude of the RSL. The short-term response action level for a commercial/industrial exposure for TCE of 7 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) recommended by EPA in the December 2013 letter was not exceeded in any of the samples during the August 2011 event. Ultimately, these results suggest that vapor intrusion is not currently an issue in indoor air. However, vapor intrusion could become an issue if building use or construction changes or new structures are built that have less stringent HVAC operational parameters than the existing facility.

Table 7. Summary of Analytical Results for 2011 Indoor and Outdoor Air Samples

Concentrations reported in micrograms per cubic meter (µg/m ³)												
Sample ID	Sample Type	Location	Date Collected	PCE	TCE	cDCE	tDCE	VC	Freon 113	1,1,1-TCA	1,1-DCE	1,1-DCA
Outdoor Ambient Air Samples												
AMB-1	Ambient ¹	Parking lot	8/21/2011	<0.14 ²	<0.027	<0.055	<0.055	<0.013	0.67³	<0.11	<0.040	<0.020
AMB-2	Ambient	Roof	8/21/2011	<0.14	0.37	0.38	<0.055	<0.013	0.69	<0.11	<0.040	<0.020
AMB-3	Ambient	Equipment pad	8/21/2011	<0.14	0.11	0.21	<0.056	<0.013	0.71	<0.11	<0.040	<0.020
AMB-4	Ambient	Equipment pad	8/21/2011	<0.14	0.55	0.60	<0.056	<0.013	0.76	<0.11	<0.040	<0.020
AMB-5	Ambient	Equipment pad	8/21/2011	<0.14	0.043	<0.055	<0.055	<0.013	0.74	<0.11	<0.040	<0.020
Indoor Air Samples												
IA-1	Preferential Pathway ⁴	Mechanical room with AH-1	8/21/2011	<0.14	1.6	10	0.17	<0.013	1.2	0.17	0.073	0.048
IA-2	Breathing Zone ⁵	Office Area (supplied by AH-1)	8/21/2011	<0.14	1.4	9.9	0.15	<0.013	1.3	0.18	0.063	0.046
IA-3	Preferential Pathway	Storage room	8/21/2011	<0.14	0.94	7.9	0.093	<0.013	0.98	<0.11	<0.040	0.031
IA-4	Preferential Pathway	Mechanical room with air handlers	8/21/2011	<0.14	0.56	0.53	<0.055	<0.013	0.73	<0.11	<0.040	<0.020
IA-5	Preferential Pathway	Adjacent to elevator shaft	8/21/2011	<0.14	2.0	0.67	<0.055	<0.013	0.72	<0.11	<0.040	<0.020
IA-6	Breathing Zone	Electrical test area (supplied by AH-6)	8/21/2011	<0.14	1.9	0.66	<0.056	<0.013	0.77	<0.11	<0.040	<0.020
IA-7	Preferential Pathway	Mechanical room with air handlers	8/21/2011	<0.14	0.20	0.068	<0.055	<0.013	0.71	<0.11	<0.040	<0.020
IA-70	Blind Field Duplicate ⁶		8/21/2011	<0.14	0.19	0.062	<0.055	<0.013	0.77	<0.11	<0.040	<0.020
IA-8	Breathing Zone	Office area (supplied by AH-2)	8/21/2011	<0.14	0.96	4.6	0.080	<0.013	1.0	0.12	<0.040	<0.020
IA-80	Blind Field Duplicate		8/21/2011	<0.14	0.99	4.7	0.085	<0.013	1.0	0.12	<0.040	0.024
IA-9	Breathing Zone	Office area (supplied by AH-39)	8/21/2011	<0.14	0.65	0.33	<0.055	<0.013	0.80	<0.11	<0.040	<0.020
IA-10	Breathing Zone	Office area (supplied by AH-10)	8/21/2011	<0.14	0.58	0.80	<0.055	<0.013	0.69	<0.11	<0.040	<0.020
IA-11	Breathing Zone	Office area (supplied by AH-3)	8/21/2011	<0.14	0.52	0.62	<0.056	<0.013	0.68	<0.11	<0.040	<0.020
IA-12	Breathing Zone	Office area (supplied by AH-4)	8/21/2011	<0.14	0.57	0.77	<0.056	<0.013	0.72	<0.11	<0.040	<0.020
IA-13	Breathing Zone	Cafeteria (supplied by AH-43)	8/21/2011	<0.14	1.1	0.36	<0.055	<0.013	0.74	<0.11	<0.040	<0.020
IA-14	Breathing Zone	Office area (supplied by AH-9)	8/21/2011	<0.14	1.0	0.22	<0.055	<0.013	0.91	<0.11	<0.040	<0.020
IA-15	Breathing Zone	Conference room (supplied by AH-6)	8/21/2011	<0.14	2.8	0.90	<0.056	0.018	0.89	<0.11	<0.040	<0.020
IA-16	Preferential Pathway	Adjacent to elevator shaft	8/21/2011	<0.14	1.1	0.48	<0.055	<0.013	0.83	<0.11	<0.040	<0.020
Maximum Detected Indoor Air Concentration				ND	2.8	10	0.17	0.018	1.3	0.18	0.073	0.048
U.S. EPA Region 9 Regional Screening Level (RSL) for Industrial Air⁷				2.08⁸	3.0	31⁸	260	0.16⁸	130,000	4,400⁸	310⁸	7.7
Notes 1. Ambient samples were collected outdoors, in an approximate upwind direction of the building and/or near the intake of the building's HVAC system. 2. "<" indicates that the analyte was not detected at or above the laboratory reporting limit shown. 3. Results shown in bold indicate that the analyte was detected in the sample at or above the laboratory reporting limit. 4. Preferential pathway samples were collected indoors, as close as possible to a potential source. Preferential pathway sample results are not necessarily representative of employee exposure. 5. Breathing zone samples were collected indoors from the approximate height of a seated worker. 6. Each duplicate sample was collected simultaneously the associated primary sample, using a T-splitter. 7. Regional Screening Level (RSL) for Industrial Air (U.S. EPA, 2013, Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites, November). 8. California-modified indoor air screening level (California Department of Toxic Substances Control, Office of Human and Ecological Risk, 2013, HERO HHRA Note Number: 3, May 21).												
Abbreviations PCE = tetrachloroethene TCE = trichloroethene cDCE = cis-1,2-dichloroethene tDCE = trans-1,2-dichloroethene VC = vinyl chloride Freon 113 = 1,1,2-trichloro-1,2,2-trifluoromethane 1,1,1-TCA = 1,1,1-trichloroethane 1,1-DCE = 1,1-dichloroethene 1,1-DCA = 1,1-dichloroethane HVAC = heating, ventilation, and air conditioning ND = not detected												

November 2011 Limited Phase II ESA (Treadwell and Rollo 2012)

In November 2011, as part of the Limited Phase II ESA, 10 exterior soil gas samples were taken at the perimeter of the main facility. Three samples exceeded the commercial sub-slab or soil gas VISL for TCE ($30 \mu\text{g}/\text{m}^3$, Treadwell and Rollo 2012). However, as discussed above, the short-term indoor air response action level for TCE ($7 \mu\text{g}/\text{m}^3$) for interior commercial/industrial exposure was not exceeded during the August 2011 assessment of the main facility (AMEC 2011a). Benzene and chloroform exceeded their commercial sub-slab or soil gas VISLs of 16 and $5.3 \mu\text{g}/\text{m}^3$, respectively (Treadwell and Rollo 2012). Benzene and chloroform were not analyzed for in indoor air samples in the August 2011 assessment of the main facility (AMEC 2011a). Chloroform, a by-product of drinking water disinfection, is often detected in the indoor air samples of buildings served by public water utilities, and thus a potential confounding indoor source of this Chemical of Concern [COC].

Five soil gas samples were collected at the perimeter of Submicron Development Center (SDC) building, and their TCE, benzene, and chloroform concentrations exceeded their commercial sub-slab or soil gas VISLs. Eight sub-slab samples were collected at locations within the SDC building, and their benzene and ethylbenzene concentrations exceeded their commercial sub-slab or soil gas VISLs (16 and $49 \mu\text{g}/\text{m}^3$, respectively). Additional probes were installed to assess the extent of benzene and ethylbenzene contamination, and the results indicated that the benzene and ethylbenzene impacts were limited to the original sample locations. No indoor air sampling of the SDC building in 2011 because the building was not been occupied.

November 2013 Phase II ESA (ENGEO 2013)

In November 2013, as part of the Phase II ESA, 20 soil gas were collected from across the property from a depth of approximately 5 feet bgs. Five samples, all on the western portion of the property, exceeded the commercial sub-slab or soil gas VISL for TCE ($30 \mu\text{g}/\text{m}^3$, ENGEO 2013). In addition, six samples exceeded the commercial sub-slab or soil gas VISL for benzene ($16 \mu\text{g}/\text{m}^3$); chloroform was not detected in any samples. As noted previously, benzene was not analyzed in indoor air in the August 2011 assessment of the main facility; however, it was also not detected in groundwater.

Toxicity Values Toxicity Values: EPA's Integrated Risk Information System (IRIS) periodically updates chemical specific toxicity profiles as sufficient new information becomes available. IRIS was used as the primary reference for new toxicity values. However, California's Office of Health Hazard Assessment (OEHHA) also produces similar chemical toxicity reviews that are applicable in the state. These were used if they are significantly more health protective. Using the updated toxicity values, EPA periodically updates the Regional Screening Levels (RSLs) using risk assessment guidance from the EPA Superfund program. They are risk-based media concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. Based on the toxicity characteristics of the chemical, there can be either or both non-cancer RSLs and /or cancer RSLs. RSLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime.

Any concentration below the non-cancer RSL indicates that no adverse health effect from exposure is expected, while concentrations significantly above the non-cancer RSL may indicate an increased potential for non-cancer effects. The cancer RSL is based on a 10^{-6} excess cancer risk which is at the

lower limit in EPA's acceptable risk management range of 10^{-4} to 10^{-6} excess cancer risk, any clean-up level within the risk management range is considered protective.

As shown in Table 8, the non-cancer RSLs are greater than the ROD cleanup levels for all COCs except hexavalent chromium, 1,2,4-trichlorobenzene, TCE, and xylenes. Of these compounds, 1,2,4-trichlorobenzene and TCE have been detected in the aquifer above their respective non-cancer RSLs and cleanup standards. The health protective cleanup levels chosen in the ROD are based on MCLs, Safe Drinking Water Act Maximum Contaminant Levels, which are considered protective.

The ROD clean-up levels are also greater than their corresponding cancer RSL. However, all the ROD clean-up levels, except chloroform and hexavalent chromium, are still within the excess cancer risk range considered protective. However, based on the 2013 Annual report, chloroform and hexavalent chromium were not detected.

Table 8. Comparison of Cleanup Standards and Current MCLs to May 2014 RSLs

Contaminants of Concern	1991 Final SCR Cleanup Standards (µg/L)	Current Federal MCL (µg/L)	Current State MCL (µg/L)	Non-cancer Tap water Multipathway RSL (µg/L) ^d	Cancer Tap water Multipathway RSL (µg/L) ^d
Benzene	1	5	1	29	0.39
Chromium (Total)	50	100 ^a	50 ^a	16,000	--
Chromium (VI)	50	100 ^a	50 ^a (10 ^b)	31	0.031
Chloroform	100	70 ^c	--	84	0.19
1,1-dichloroethane (1,1-DCA)	5	--	5	2,900	2.4
1,1-dichloroethene (1,1-DCE)	6	7	6	260	--
cis-1,2-dichloroethene (cis-1,2-DCE)	6	70	6	28	--
trans-1,2-dichloroethene (trans-1,2-DCE)	10	100	10	86	--
Ethylbenzene	680	700	300	670	1.3
Freon 113	1,200	--	1,200	53,000	--
Tetrachloroethene (PCE)	5	5	5	35	9.7
Toluene	150	1,000	150	860	--
1,2,4-trichlorobenzene	70	70	5	3.9	0.99
1,1,1-trichloroethane (1,1,1-TCA)	200	200	200	7,500	--
Trichloroethene (TCE)	5	5	5	2.6	0.44
Trichlorofluoromethane (Freon 11)	150	--	150	1,100	--
Xylenes (total)	1,750	10,000	1,750	190	--
Vinyl chloride	0.5	2	0.5	36	0.015

Notes:

- Currently, there is no Federal or State MCL for chromium (III) or chromium (VI). The value listed is for total chromium.
- Value of 10 µg/L for hexavalent chromium was proposed by California Department of Public Health on 23 August 2013
- Value listed is the Maximum Contaminant Level Goal (MCLG) for chloroform.
- Bolded values are less than the lowest value of the cleanup standards in the SCR, current federal MCL (or non-zero MCLG), or current state MCL

In 2010, EPA updated its Regional Screening Levels (RSLs) for hexavalent chromium. The RSL update was based on a revised toxicity assessment by the New Jersey Department of Environmental Protection

that used new toxicity information from the National Toxicology Program. The current hexavalent chromium RSL for tap water ingestion is 0.031 µg/L. The U.S. EPA IRIS program is conducting its own re-assessment of the toxicity of hexavalent chromium and EPA has committed to revising the chromium MCL upon completion of the IRIS re-assessment.

Ecological Review

The ROD addressed the presence of sensitive ecological systems and determined that the AMD 915 Site did not constitute critical habitat for endangered species, and that it did not include or impact wetlands. No changes at the site have occurred that might change this ecological assessment.

6.4. Data Review

Groundwater

Groundwater data collected from 1982 through 2013 were reviewed as part of this FYR (AMEC 2009, 2010, 2011b, 2012e, 2013a; Haley and Aldrich 2014c). The current monitoring program consists of 36 wells: 9 extraction wells and 27 monitoring wells.

In the A-zone, groundwater elevation measurements indicate that horizontal groundwater flow is generally toward the northeast (Figure 4). Extraction wells EW-1 through EW-6 create a depression of the potentiometric surface under the parking lot north of the 915 DeGuigne building. The hydraulic gradient of the A-zone, from well 36-S to 8-S, was approximately 0.0088 ft/ft in October 2012. The direction of the vertical hydraulic gradient between the A-zone and the underlying B1-zone is generally downward north of the building at well pairs 19-S/19-D and 40-S/40-D, and upward near to and southwest of the building at well pairs 41-S/41-D and 49-S/49-D.

In the B1-zone, groundwater elevation measurements indicate that horizontal groundwater flow is generally toward the northeast (Figure 5), and a depression in the potentiometric surface is evident in the vicinity of extraction wells EW-1 through EW-6 (shown in the A-zone on Figure 4). The hydraulic gradient of the B1-zone, from well 36-D to 20-D, was approximately 0.0087 ft/ft in October 2012. The direction of the vertical hydraulic gradient between the B1-zone and the underlying B2-zone is downward across the site as calculated at well pairs 20-D/20-DD, 10-D/43-DD, and 49-D/49-DD.

In the B2-zone, groundwater elevation measurements indicate that horizontal groundwater flow is generally toward the north, but strongly influenced by pumping at extraction well EW-9 and nearby off-property extraction wells (Figure 6). The hydraulic gradient of the B-2 zone, from well 36-DD to 20-DD, was approximately 0.0096 ft/ft in October 2012. The direction of the vertical hydraulic gradient between the B2-zone and the underlying B3-zone is upward at well pair 18-DD and 50-DDD. Because no other B3-zone monitoring wells exist, the direction of horizontal groundwater flow in the B3-zone cannot be determined.

At this site, TCE and cis-1,2-DCE are the COCs most frequently detected in groundwater above cleanup standards. Figure 7 through Figure 9 show the TCE distribution in the A-, B1-, and B2-zones for the October 2013 monitoring event. Figure 10 through Figure 12 show the cis-1,2-DCE distribution in the A-, B1-, and B2-zones for the October 2013 monitoring event.

Pumping from on-site wells appears to have a substantial impact on the direction of flow. Groundwater elevation contours in the A-, B1-, and B2-zones (Figure 4, Figure 5, and Figure 6) suggest that groundwater flow west of the AMD 915 Site shifts to the northeast toward the on-site extraction wells, indicating that there may be capture of contaminants from the offsite plumes to the west. The contaminant contour figures (Figure 7 through Figure 12), though, do not necessarily confirm that this is occurring. Rather, the contaminant contours generally seem to indicate that there are somewhat distinct plumes to the west of the Site and through the middle of the AMD 915 Site.

The highest concentration areas on the AMD 915 Site are located in the B1- and B2-zones north of the building in the vicinity of the former ANS source area (Pad C). The ANS source area was excavated and backfilled to a depth of about 30 feet bgs, but the B1- and B2-zones are deeper than the excavation. Contaminant contours in these areas (Figure 9 and Figure 11) suggest that these high concentration areas are caused by upgradient (off-site) sources. Uncertainties regarding the upgradient contaminant distribution are also noted on the other B1- and B2-zone figures (Figure 8 and Figure 12). Monitoring data for the B1- and B2-zones on the AMD property south of the 915 building and even further upgradient may help to better define the extent of the plumes and the impacts of upgradient sources on the AMD 915 Site. Such data should be used if available.

Additionally, the northern extent of the plumes across Duane Avenue is not shown on contour maps in the A- and B1-zones (Figure 7, Figure 8, Figure 10, and Figure 11). The area across Duane Avenue is part of the Offsite OU. The northern extent of the plume across Duane Avenue should be shown if data are available to give a better visual representation of the contaminant plumes (i.e., it is unlikely that the plumes just stop at the property boundary as currently shown in the 2013 Annual Groundwater Monitoring Report (Haley and Aldrich 2014c)). Furthermore, groundwater elevation data north of Duane Avenue should be used, if available, to show a more complete picture of groundwater levels and flow direction.

Also, it does not appear that VOC concentrations in the extraction wells were used to develop the TCE and cis-1,2-DCE contours (Haley and Aldrich 2014c). For example, the TCE concentrations in EW-1 and EW-2 (screened across the A- and B1-zones) in October 2013 were 93 and 130 µg/L, respectively. However, Figure 7 shows EW-1 and EW-2 between the 5 and 50 µg/L contours, and Figure 8 shows EW-1 between the 5 and 50 µg/L contours and EW-2 between the 50 and 100 µg/L contours. Furthermore, the EW-8 (screened only in the B2-zone) TCE concentration in October 2013 was 93 µg/L, and Figure 9 shows EW-8 between the 5 and 50 µg/L contours. Extraction well data should be included in the development of contaminant contours. Should additional interpretation be necessary when using data from extraction wells that span the A- and B1-zones, any methods or assumptions should be documented in future monitoring reports.

From 2008 to 2013, vinyl chloride was consistently detected above the cleanup standard (0.5 µg/L) in monitoring wells 2-S, 41-S, 10-D, 40-D, 41-D, and 42-DD. Except for 42-DD, these wells are located on the western boundary of the site and the vinyl chloride is likely associated with the Offsite OU plume. Vinyl chloride in 42-DD may be related to a plume that has migrated onto the AMD 915 Site from another off-site source. It is possible that vinyl chloride could have been detected above the cleanup standard in more wells, but since the reporting limits for vinyl chloride (0.5 to 2.5 µg/L) are sometimes

greater than the cleanup standard, it is not possible to determine if the cleanup standard was exceeded. The reporting limit should be no higher than the cleanup standard, where practicable.

From 2011 to 2013, 1,2,4-trichlorobenzene was consistently detected significantly above the cleanup standard (5 µg/L) in extraction wells EW-5 and EW-6. Concentrations of 1,2,4-trichlorobenzene were not reported prior to 2011, and haven't been detected above the cleanup standard in any other extraction or monitoring wells.

In November 2010, trans-1,2-DCE was detected above the cleanup standard (10 µg/L) in monitoring well 42-DD, which may be associated with a plume that has migrated onto the AMD 915 Site from off-site sources. However, trans-1,2-DCE has not exceeded the cleanup standard in any other samples, including samples from this well, between 2008 and 2013.

Plots of TCE and cis-1,2-DCE data from 1984 to 2013 are provided in Appendix H (Haley and Aldrich 2014c). Long-term data trends were calculated for TCE and cis-1,2-DCE in extraction wells EW-1 through EW-9 (excluding EW-3, which is no longer in use due to non-detect concentrations since sampling began in the 1980s) using the Mann-Kendall nonparametric test for trend (Table 9). For TCE, the test indicated either no trend, or a decreasing trend in all extraction wells; there were no increasing trends. For cis-1,2-DCE, there were increasing trends in extraction wells EW-1, EW-4, and EW-9. The results of Mann-Kendall trend tests are rather difficult to interpret for this site because of the influence of off-site sources of cis-1,2-DCE and/or reductive dechlorination of TCE (TCE is a pre-cursor to cis-1,2-DCE). Regardless, TCE and cis-1,2-DCE concentrations in extraction wells (except EW-3) and many monitoring wells are generally above their respective cleanup standards. Due to the migration of contaminants onto the AMD 915 Site from off-site sources, it seems unlikely that TCE or cis-1,2-DCE concentrations will decrease below the cleanup standards in the next five years. In fact, these concentrations may be present for years to come unless these off-site sources are addressed.

Table 9. Mann-Kendall Test for Trend for Extraction Wells (1984-2012)

Well	TCE		cis-1,2-DCE	
	Concentration Trend	Confidence in Trend (%)	Concentration Trend	Confidence in Trend (%)
EW-1	No Trend	58.9	Increasing	99
EW-2	Decreasing	100	Decreasing	100
EW-4	No Trend	58.7	Increasing	99.9
EW-5	Decreasing	100	Probably Decreasing	90.1
EW-6	Decreasing	100	Decreasing	100
EW-7	Decreasing	99.9	Decreasing	100
EW-8	Decreasing	100	Stable	78.5
EW-9	Decreasing	100	Increasing	100

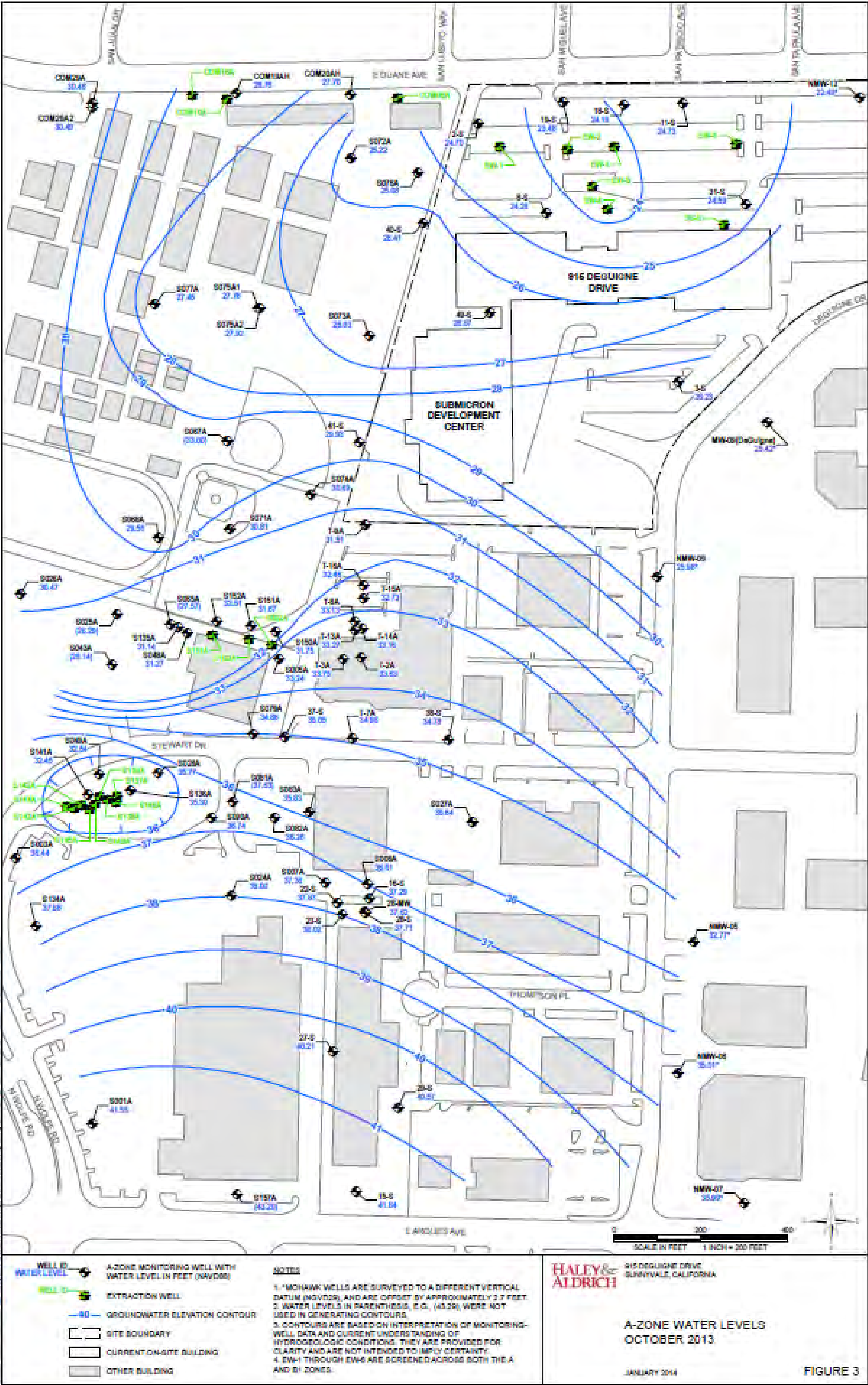


Figure 4. A-Zone Water Levels in October 2013

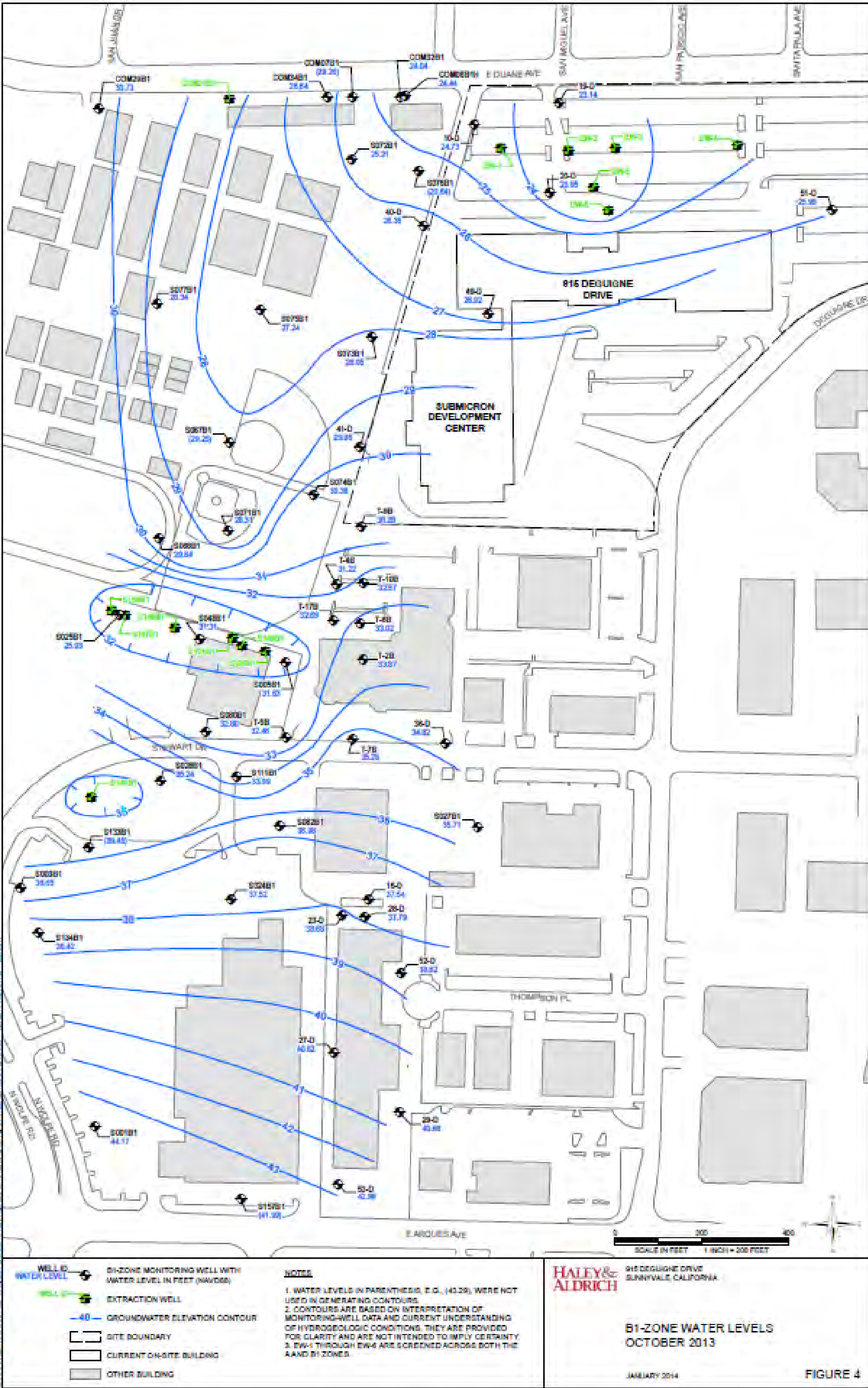


Figure 5. B1-Zone Water Levels in October 2013

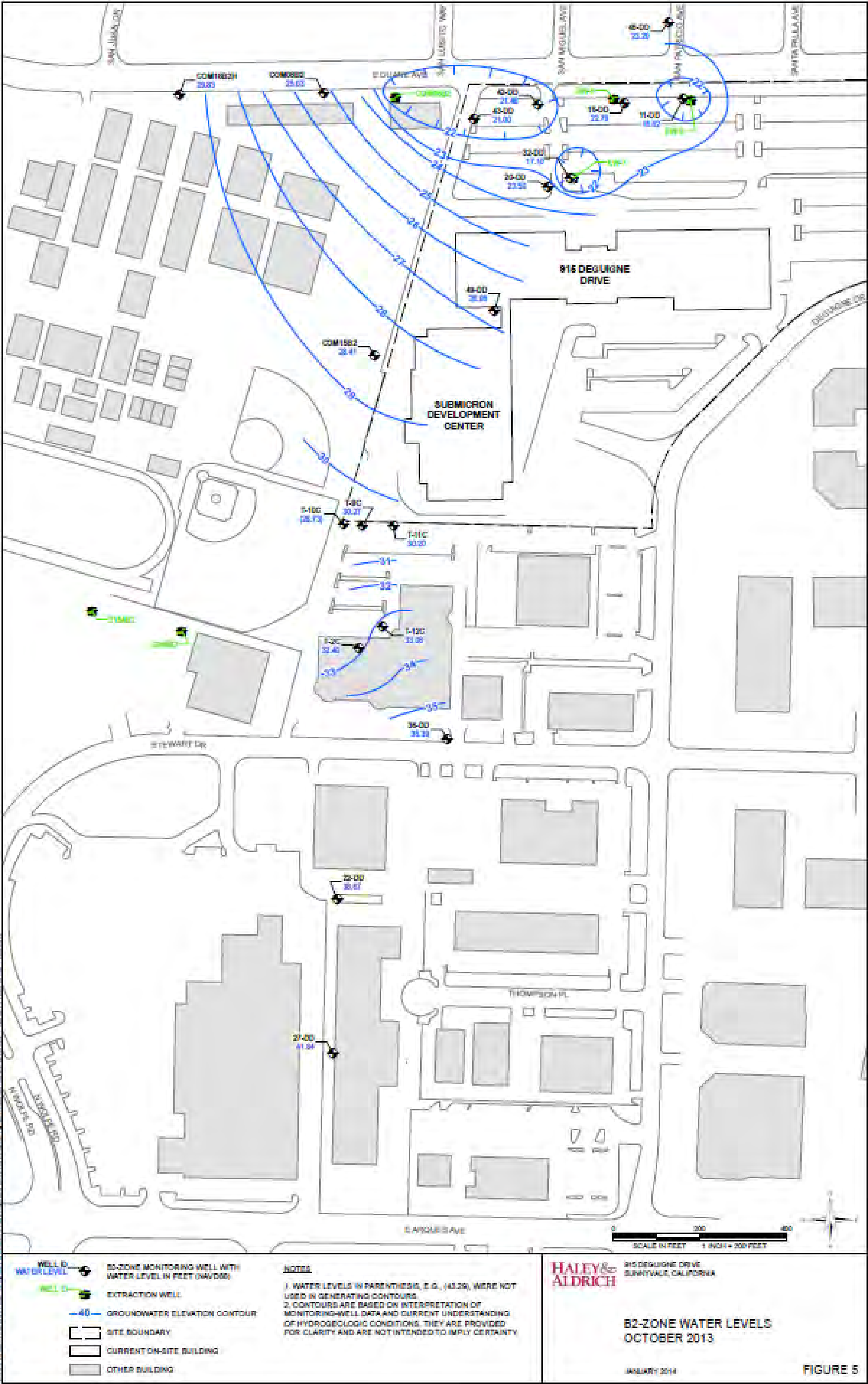


Figure 6. B2-Zone Water Levels in October 2013



Figure 7. A-Zone TCE Contours in October 2013



Figure 8. B1-Zone TCE Contours in October 2013



Figure 9. B2-Zone TCE Contours in October 2013

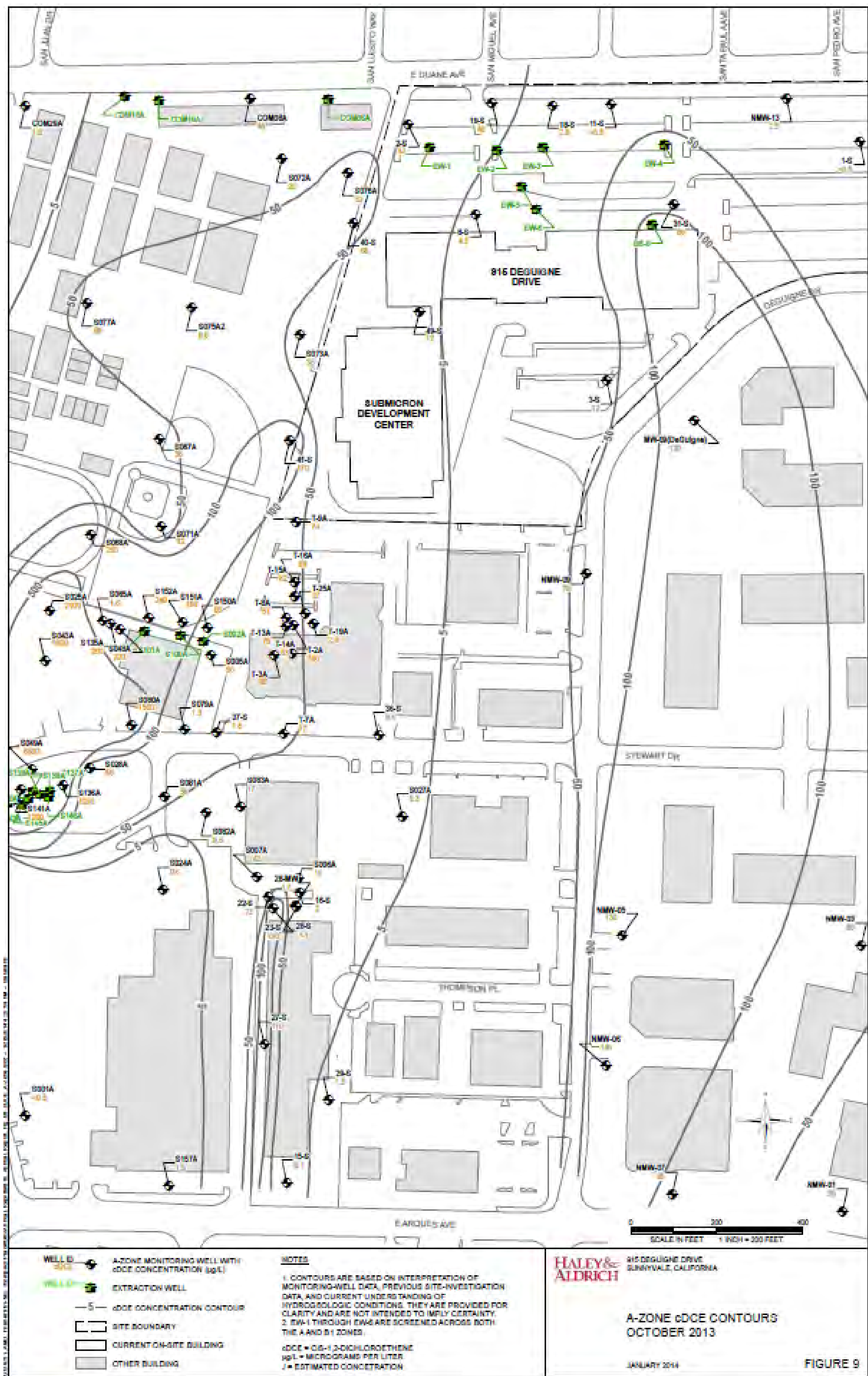
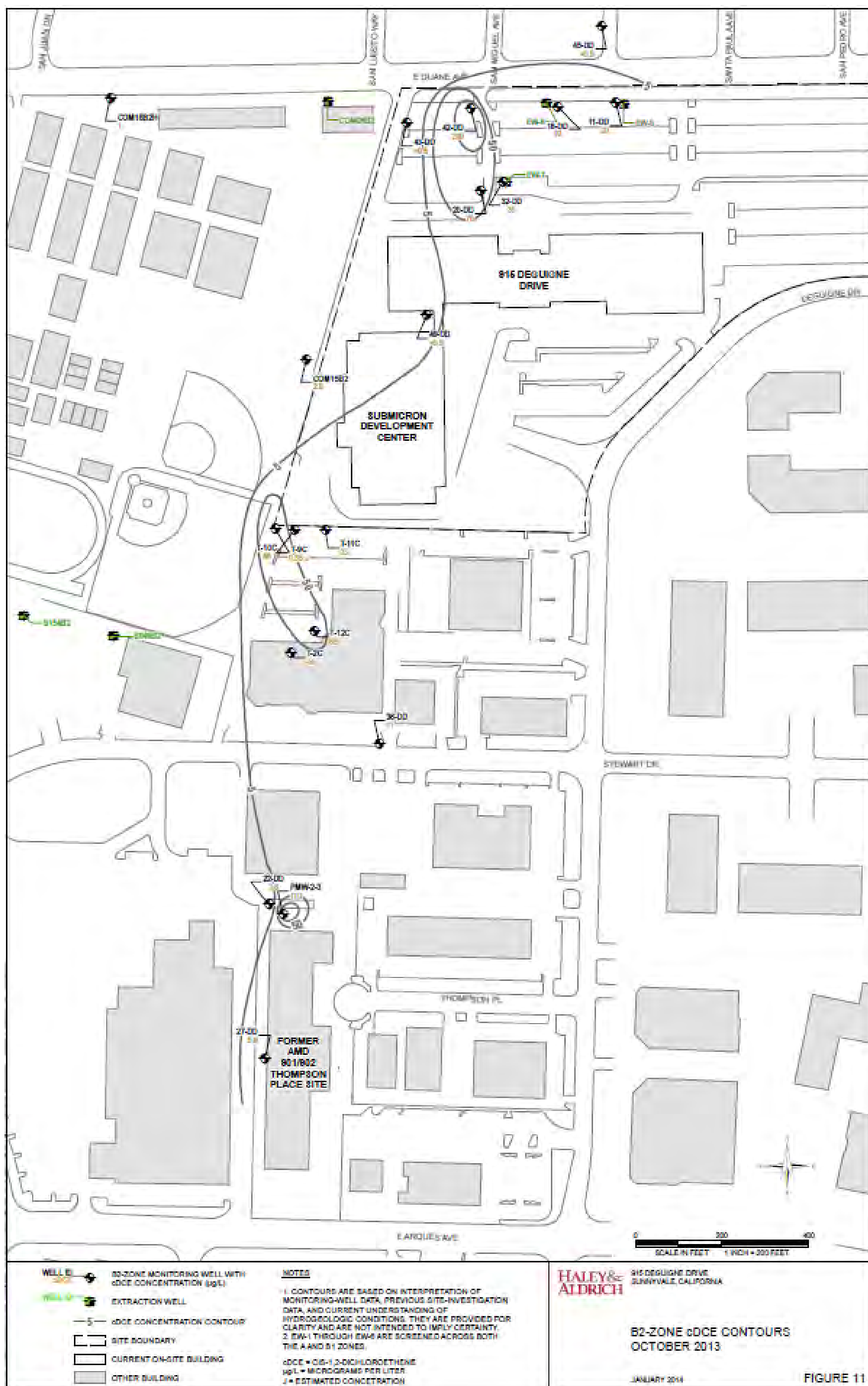


Figure 10. A-Zone cis-1,2-DCE Contours in October 2013





Groundwater Extraction and Treatment System

The mass of VOCs removed has generally declined over time, even though the volume of groundwater treated has remained somewhat steady (Figure 13). The decline in efficiency is due to decreasing average influent VOC concentrations, which have ranged from 504 µg/L in 1999 to 165 µg/L in 2011.

In 2007, AMD conducted groundwater characterization of the upgradient (off-site) areas (Geomatrix 2008). Interpretation of the results suggested that the on-site VOC source (the contamination associated with the ANS tank that was removed) would have little remaining impact on groundwater due to the success of previous remedial actions (i.e., soil removal actions and early operation of the GWET system). The results also suggested that upgradient (off-site) releases are the primary reason that little apparent progress has occurred during this FYR period in reducing groundwater contamination further. Continued operation of the GWET system does not remediate upgradient (off-site) sources, but provides adequate hydraulic containment of the resultant plumes. The migration of COCs off the AMD 915 Site is curtailed by operation of the GWET system, though the system was not designed for this purpose.

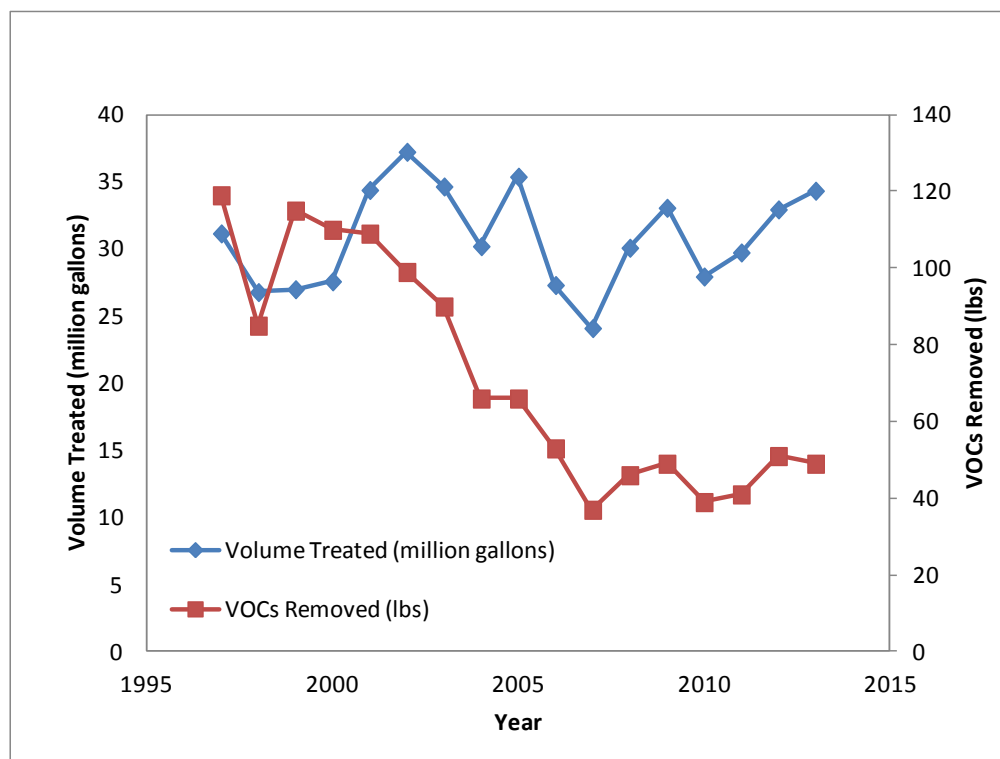


Figure 13. Volume Treated and VOCs Removed by the GWET System over Time

Soil

On-site soil samples taken during the November 2011 Limited Phase II ESA (Treadwell and Rollo 2012) and the April 2013 Subsurface Investigation for the City of Sunnyvale (Ground Zero Analysis, Inc. 2013) indicated that shallow soils (less than 3 feet bgs) in some locations exceeded the RWQCB Environmental Screening Levels (ESLs) or the EPA RSLs for dichlorodiphenyldichloroethene (DDE) and dieldrin in

residential soils. However, these compounds do not appear to be related to site activities and are likely associated with historical (pre-1974) agricultural activities. None of the 18 soil samples in the November 2013 Phase II ESA exceeded the ESLs or RSLs for DDE or dieldrin, potentially because samples were homogenized in one-foot sections in the laboratory; this kind of homogenization was not performed in the other investigations.

6.5. Site Inspection

A site inspection was completed on October 24, 2013, and attended by Ellen Engberg and Aaron King (USACE, Seattle district), Melanie Morash (USEPA Region 9), Max Shahbazian (California RWQCB), Peter Bennett and Michael Calhoun (Haley & Aldrich), and Do Cao (AMD). The site inspection checklist is provided in Appendix D, and the site inspection photographs are provided in Appendix E.

During the site visit, the site was occupied and well-controlled by Spansion. The groundwater extraction and treatment system appeared to be in good condition, and there were no signs of institutional controls being violated.

6.6. Interviews

During the FYR process, an interview was conducted with the site operator and O&M contractors involved with the AMD 915 Site. The purpose of the interview was to document the perceived status of the Site and any perceived problems or successes with the phases of the remedy that have been implemented to date. The interview was conducted during the site visit on October 24, 2013. The collective interview is summarized below, and the completed interview form is provided in Appendix C.

Aaron King and Ellen Engberg of USACE interviewed Peter Bennett (lead hydrogeologist for Haley & Aldrich and contractor for the responsible party), Michael Calhoun (senior hydrogeologist for Haley & Aldrich), and Do Cao (site operator for AMD); Mr. Bennett, Mr. Calhoun, and Mr. Cao represented a single perspective and were interviewed together. The project is in the post-construction operations and maintenance (O&M) phase, and no current problems or issues were identified during the interview, except for a one-time exceedance of cis-1,2-DCE in treatment system effluent in November 2012.

6.7. Institutional Controls

The ROD called for a deed restriction prohibiting the use of shallow groundwater for drinking. A restrictive covenant was recorded on August 7, 1992, specifically restricting the following: the use of the upper water-bearing aquifers as a source and/or supply of drinking water; and the drilling, construction, installation, inspection, maintenance, replacement, removal, use, or operation of any groundwater extraction wells or groundwater monitoring wells, except for those used in the investigation, characterization, and remediation of groundwater pursuant to any order of a governmental or regulatory agency.

The previous FYR (RWQCB 2009) identified the deed restriction as an issue. The existing covenant was recorded prior to adoption of California Civil Code section 1471, and the previous FYR recommended that a new environmental restrictive covenant should be recorded for the property consistent with current California law. AMD no longer owns the AMD 915 Site and does not have the legal right to record a new

deed restriction on the property. In compliance with the requirements of the last FYR, AMD prepared a revised deed restriction in consultation with the current owner at that time (Spanion) and provided it to the California Regional Water Quality Control Board (RWQCB) and EPA in 2012 for review. In 2013, AMD worked with Spanion and Watt Investments at Sunnyvale, who purchased the Site from Spanion on 23 January 2014, to further revise the draft deed restriction at the request of Watt. RWQCB is working with the new owner to lodge an updated deed restriction.

7. Technical Assessment

7.1. Question A: Is the remedy functioning as intended by the decision documents?

Yes, the remedy is functioning as intended by the Final SCR and the ROD. The Final SCR and ROD called for air stripping of extracted groundwater followed by GAC polishing; the current system, as modified in 2012 with RWQCB approval, consists only of GAC treatment. Containment of COCs on the Site appears to be largely effective due to operation of the GWET system. In other words, contamination on the AMD 915 Site does not appear to be migrating off the Site.

Operating procedures, as implemented, will maintain the effectiveness of response actions (i.e., prevent contamination from migrating off the site). There have been no large variances in O&M costs that could indicate potential remedy problems or issues.

The remedy was recently optimized by switching from air stripping with GAC polishing to just a GAC vessel operation, leading to lower power consumption.

Groundwater samples are collected by Teflon bailer after purging the well with a submersible pump. The bailer and the pump are then steam-cleaned between uses. The sampling contractor should consider using passive sampling technologies such as the HydraSleeve or polyethylene (or passive) diffusion bags. These passive technologies are proven, easy to use, inexpensive, can sample discrete well intervals, and do not require purging the well (which may result in substantially less investigation-derived waste and associated analysis and disposal costs).

The 2008 Subsurface Investigation Report (Geomatrix 2008) indicated that upgradient, off-site sources were contributing significantly to the VOC contamination remaining on the AMD 915 Site. The GWET system has continued to operate and provide containment. However, it is not clear how the remedy at AMD 915 fits into the overall area-wide plume restoration effort.

The 1992 restrictive covenant prohibits the use of groundwater from the shallow aquifers (i.e., the A-, B1- and B2-zone aquifers) as a source of drinking water. However, a new restrictive covenant that complies with California Civil Code section 1471 has not yet been recorded as previously recommended, RWQCB is working with the new owner to lodge an updated deed restriction.

7.2. Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of the Final SCR and ROD have changed, however, the remedy still remains protective.

Chemical-specific ARARs, which are the basis for the cleanup standards, have changed for chloroform, ethylbenzene, hexavalent chromium and 1,2,4-trichlorobenzene in groundwater since the Final SCR and ROD. The new values for these compounds are all lower (i.e., more stringent) than the values in the Final SCR and ROD. However, there is no exposure to contaminated groundwater since the existing restrictive covenant prohibits the use of site groundwater as a source of drinking water. Therefore, the changes in cleanup standards do not affect the current protectiveness of the remedy. There are no newly promulgated standards that affect the protectiveness of the remedy.

Although the land use has not changed within the last five years, the AMD 915 Site has been purchased recently by Watt. The Site is currently zoned for industrial use, but the zoning may change in the future. The Limited Phase II ESA conducted in 2011 (Treadwell and Rollo 2012) suggests that the site was being evaluated for re-zoning from commercial/industrial to residential and mixed-use commercial/residential units. If residential structures are to be built on the Site in the future, a re-evaluation of vapor intrusion would be necessary. Furthermore, the April 2013 subsurface investigation for the City of Sunnyvale (Ground Zero Analysis, Inc. 2013) suggests that, as part of redevelopment plans, the project proponent intended to dedicate approximately 5.8 acres to the City of Sunnyvale for a public park. The current owner (Watt) may build a small private park on the property for future residents of apartments and condos.

Within the last five years, there have not been any newly identified human health or ecological receptors or routes of exposure, but the vapor intrusion pathway was identified in the third FYR and evaluated at the site in 2011 and re-evaluated in 2014. Results of the August 2011 Indoor Air Investigation (AMEC 2011a) suggest that VOC concentrations in indoor air do not exceed health-protective screening levels. Benzene and chloroform were not analyzed for in indoor air in the August 2011 Investigation. However, the November 2011 (Treadwell and Rollo 2012) and November 2013 (ENGEO 2013) Phase II ESAs indicated that benzene and chloroform were detected above their respective VISLs in soil gas.

All but one of the heating, ventilation and air conditioning (HVAC) units serving the occupied AMD 915 building remained on during the August 2011 indoor air sampling event (due to the presence of laboratories and other sensitive-use rooms, such as “clean” rooms, which would have been compromised if their respective HVAC units had been deactivated). Thus the indoor air measurements obtained may not represent the full spectrum of potential vapor intrusion at the AMD 915 building and it is unknown if an HVAC-based remedy is indeed necessary to address the subsurface-to-indoor air vapor intrusion pathway, or such as might be the case given the recent change in property ownership and any subsequent changes in building occupancy, use or structure.

If the building use were to change such that the HVAC system is operated differently than when it was sampled in 2011, indoor air concentrations may be higher than those measured during the 2011 indoor air

assessment. Also, if new buildings were to be constructed on the property, they could likely experience different vapor intrusion pathways. Thus, vapor intrusion may need to be re-evaluated if the building use changes significantly or if the current buildings are removed and replaced by new structures.

To be protective in the long-term for current occupants of the AMD 915 building, it is recommended that a ventilation Operations, Maintenance & Monitoring (OM&M) plan be prepared.

Recent soil samples (Treadwell and Rollo 2012, Ground Zero Analysis, Inc. 2013) indicated that shallow soil in some on-site locations exceeded the RWQCB ESLs or the EPA RSLs for DDE and dieldrin in residential soils. However, these compounds do not appear to be related to site activities and are likely associated with historical (pre-1974) agricultural activities.

There are no unanticipated toxic byproducts of the remedy not previously addressed by the Final SCR and ROD. Physical conditions (e.g., hydrogeology) or the understanding of these conditions have not changed in a way that could affect the protectiveness of the remedy.

Though toxicity factors have changed for several site COCs as described in Section 6.3, they have not changed in a way that could affect the protectiveness of the remedy because there are no receptors. No other contaminant characteristics have changed in a way that could affect the protectiveness of the remedy.

The remedy is generally progressing as described by the RAOs. Exposure of human receptors to contaminated groundwater is being prevented by the restrictive covenant. The groundwater is being monitored regularly. Contaminant migration off the AMD 915 Site is largely being controlled and curtailed by the GWET system. However, migration of contaminants onto the Site from off-site sources is hindering the restoration of contaminated groundwater and its potential future use as drinking water. Actions for upgradient (off-site) sources will likely be needed before AMD 915 site groundwater could be used as drinking water.

7.3. Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has become available that could call into question the effectiveness of the remedy. There are no known new ecological risks, no expected impacts from natural disasters, and no other general activities or information that could change the protectiveness of the remedy.

7.4. Technical Assessment Summary

The Final SCR and ROD called for air stripping of extracted groundwater followed by GAC polishing. The current system, as modified in 2012 with RWQCB approval, consists only of GAC treatment. Cleanup standards are not being achieved, at least partly due to the migration of off-site contaminants onto the Site. Recent data show that TCE and cis-1,2-DCE exceed cleanup standards in groundwater across much of the Site. In addition, vinyl chloride and 1,2,4-trichlorobenzene have been detected in select wells above their respective cleanup standards. Containment of COCs on the Site, however, appears to be largely effective due to operation of the GWET system.

The 1992 restrictive covenant prohibits the use of groundwater from the shallow aquifers (i.e., the A-, B1- and B2-zone aquifers) as a source of drinking water. RWQCB is working with the new owner to lodge an updated deed restriction.

The groundwater cleanup levels and toxicity factors for several COCs have changed since the Final SCR and ROD. These changes do not affect the protectiveness of the remedy because no one is drinking on-site groundwater and the GWET system appears to be containing contaminants on-site. Although on- and off-site land use has not changed in the last five years, it may change in the near future following the AMD 915 property's change in ownership by Watt. Vapor intrusion was evaluated in August 2011 (AMEC 2011a) and then re-evaluated in November 2013 (Haley and Aldrich 2014a), with results indicating that contaminants in the indoor air at the occupied 915 building did not exceed health-protective screening levels.

8. Issues

Table 10 summarizes the current issues for the AMD 915 Site.

Table 10. Current Issues for the AMD 915 Site

Issue	Affects Current Protectiveness (Yes or No)	Affects Future Protectiveness (Yes or No)
1) The groundwater extraction and treatment system may not be able to restore the groundwater to its beneficial use as a potential drinking water supply due to the migration of VOCs onto the AMD 915 Site from upgradient (off-site) sources.	No	Yes
2) California Civil Code section 1471 has changed since the restrictive covenant was recorded.	No	Yes
3) A State MCL for hexavalent chromium has recently been established and the MCLs for chloroform, ethylbenzene and 1,2,4-trichlorobenzene has changed.	No	Yes

9. Recommendations and Follow-up Actions

Table 11 provides recommendations to address the current issues at the AMD 915 Site.

Table 11. Recommendations to Address Current Issues at the AMD 915 Site

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current	Future
1	Establish a broader strategy for groundwater restoration for the AMD 915 taking into account the upgradient sites.	RWQCB	RWQCB/EPA	09/2019	No	Yes

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current	Future
2	A new restrictive covenant that complies with California Civil Code section 1471 should be recorded.	RWQCB	RWQCB/EPA	12/2016	No	Yes
3	An Explanation of Significant Differences should be issued to set new clean up goals for the chemicals considering the new MCLs.	EPA	EPA	09/2019	No	Yes

In addition, the following recommendations, which improve some technical aspects of site work but do not affect protectiveness, were identified during the FYR:

- Extraction well data, in addition to the monitoring well data, should be used in developing contour maps for the site in annual groundwater monitoring reports. Current plume maps may underestimate the concentrations of certain Contaminants of Concern (COCs) in groundwater at the Site. For example, maps should be corrected to accurately reflect higher trichloroethene (TCE) and cis-1,2-dichloroethene (cis-1,2-DCE) concentrations measured in extraction wells.
- Groundwater elevation and contaminant contours on maps in annual groundwater monitoring reports should extend northward past Duane Avenue if the data are available. As the maps in the 2013 Annual Groundwater Monitoring Report are currently drawn, the contours stop at the property boundary, which results in an incomplete representation of the groundwater levels and the contaminant distribution.
- Similarly, the extent of contaminant plumes in the B1- and B2-zones to the south of the AMD 915 main building are not well supported by the data provided on the maps in the annual groundwater monitoring reports. If available, monitoring data for the AMD property south of the 915 building and even further upgradient (off-site) should be used to help better define the extent of the plumes and the impacts of upgradient sources on the AMD 915 Site.
- Laboratory reporting limits for vinyl chloride in groundwater (in monitoring wells) have often been above the cleanup standard (0.5 µg/L). Consequently, it is impossible to determine whether the cleanup standard has been achieved or exceeded. The laboratory reporting limit for vinyl chloride should be no higher than the cleanup standard.
- Benzene and chloroform were detected above their respective VISLs in soil gas around the AMD 915 main facility in the November 2011 Limited Phase II ESA. Benzene was detected above its VISL in soil gas on the western portion of the property in the November 2013 Phase II ESA. However, benzene and chloroform were not analyzed for in indoor air samples from the main facility in the August 2011 Vapor Intrusion Investigation. Benzene is not detected in groundwater. Additional investigation should be conducted in the main building to confirm that benzene is not present in indoor air above protective levels. Chloroform, a by-product of drinking water disinfection, is often detected in the indoor air samples of buildings served by

public water utilities, and thus a potential confounding indoor source of this Chemical of Concern [COC].

- Due to the presence of laboratories and other sensitive-use rooms, sampling for the August 2011 Vapor Intrusion Investigation was performed when all but one of the main facility HVAC units were operational. The property has since been acquired by Watt. If the building use changes and HVAC requirements for those areas become less stringent, then additional indoor air sampling may be necessary to assess if indoor air contaminant concentrations remain below protective levels.
- As part of redevelopment activities, it is possible that the existing commercial/industrial building structures from the Site could be removed and replaced with residential structures or new or modified commercial/industrial buildings. If this occurs, the vapor intrusion pathway should be re-evaluated by performing indoor air sampling in the new structures to assess if indoor air contaminant concentrations remain below protective levels.

10. Protectiveness Statement

The remedy at the AMD 915 Site currently protects human health and the environment because the restrictive covenant prohibits the use of site groundwater for drinking water purposes, and indoor air concentrations of volatile contaminants have been below protective levels. However, in order to protective in the long term, the following actions need to be taken: 1) record a new environmental restrictive covenant for the property that is consistent with current California law, 2) establish a broader strategy for groundwater restoration for the site taking into account the upgradient sites and 3) an Explanation of Significant Differences should be issued to set new clean up goals for the chemicals considering the new MCLs.

11. Next Review

This is a statutory Site that requires ongoing FYRs as long as waste is left on site that does not allow for unlimited use and unrestricted exposure. The next FYR will be due within five years of the signature date of this FYR.

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Appendix A: List of Documents Reviewed

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List of Documents Reviewed

Advanced Micro Devices, Inc. 1999. 1999 Sampling Plans for 901 Thompson Place, 915 DeGuigne Drive and 1165 Arques Avenue in Sunnyvale. Letter to Mr. Ceilio Felix, California Regional Water Quality Control Board – San Francisco Bay Region. August 1999.

AMEC Environment and Infrastructure, Inc. 2009. 2008 Annual Groundwater Monitoring Report 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. January 2009.

AMEC Environment and Infrastructure, Inc. 2010. 2009 Annual Groundwater Monitoring Report 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. January 2010.

AMEC Environment and Infrastructure, Inc. 2011a. Report of Results—Indoor Air Sampling. 915 DeGuigne Drive Sunnyvale, California. Prepared for Advanced Micro Devices, Sunnyvale, California. Prepared by AMEC, Oakland, California, October, 2011.

AMEC Environment and Infrastructure, Inc. 2011b. 2010 Annual Groundwater Monitoring Report 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. January 2011.

AMEC Environment and Infrastructure, Inc. 2012a. Technical Status and NPDES Self-Monitoring Report. Reporting Period July – September 2012. CIWQS Place ID: 203805. 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. November 2012.

AMEC Environment and Infrastructure, Inc. 2012b. Technical Status and NPDES Self-Monitoring Report. Reporting Period April – June 2012. CIWQS Place ID: 203805. 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. August 2012.

AMEC Environment and Infrastructure, Inc. 2012c. Technical Status and NPDES Self-Monitoring Report. Reporting Period January – March 2012. CIWQS Place ID: 203805. 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. May 2012.

AMEC Environment and Infrastructure, Inc. 2012d. NPDES System Effluent Exceedance Report. CIWQS Place ID: 203805. 915 DeGuigne Drive Sunnyvale, California. Order No. R2-2009-0059, NPDES Permit No. CAG912003. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. November 2012.

AMEC Environment and Infrastructure, Inc. 2012e. 2011 Annual Groundwater Monitoring Report 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. January 2012.

AMEC Environment and Infrastructure, Inc. 2013a. Technical Status and NPDES Self-Monitoring Report. Reporting Period October – December 2012. CIWQS Place ID: 203805. 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. February 2013.

AMEC Environment and Infrastructure, Inc. 2013b. 2012 Annual Groundwater Monitoring Report 915 DeGuigne Drive Sunnyvale, California. Prepared by AMEC Environment and Infrastructure, Inc. for Advanced Micro Devices, Inc. January 2013.

California EPA (CEPA). 2011. Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). Department of Toxic Substances Control. October, 2011)

ENGEO Incorporated. 2013. ENGEO, Phase II Environmental Site Assessment, Spansion Site, 915 DeGuigne Drive, Sunnyvale, California, Project No. 10636.000.000, November 4, 2013. Prepared by ENGEO for Watt Communities. November 2013.

EPA. 1991. Record of Decision Advanced Micro Devices # 915 Superfund Site Sunnyvale, California. Prepared by EPA Region 9. 26 August 1991.

EPA 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November 2002.

EPA. 2013. EPA Region 9 Guidelines and Supplemental Information Needed for Vapor Intrusion Evaluations at the South Bay National Priorities List (NPL) Sites. Prepared by EPA Region 9. December 2013.

Geomatrix Consultants, Inc. 2008. Subsurface Investigation Report Former Advanced Micro Devices 915 DeGuigne Drive Sunnyvale, California. Prepared by Geomatrix Consultants, Inc. for Advanced Micro Devices, Inc. January 2008.

Ground Zero Analysis, Inc. 2013. Subsurface Investigation Report, Proposed Spansion Park Dedication, 915/943 DeGuigne Dr., Sunnyvale, CA RWQCB Case No. 2020423. Prepared by Ground Zero Analysis, Inc. for the City of Sunnyvale. May 2013.

Haley and Aldrich, Inc. 2013a. Technical Status and NPDES Self-Monitoring Report. Reporting Period January through March 2013. CIWQS Place ID: 203805. 915 DeGuigne Drive Sunnyvale, California. Prepared by Haley and Aldrich, Inc. for Advanced Micro Devices, Inc. May 2013.

Haley and Aldrich, Inc. 2013b. Technical Status and NPDES Self-Monitoring Report. Reporting Period April through June 2013. CIWQS Place ID: 203805. 915 DeGuigne Drive Sunnyvale, California. Prepared by Haley and Aldrich, Inc. for Advanced Micro Devices, Inc. August 2013.

Haley and Aldrich, Inc. 2014a. Vapor Intrusion Evaluation Report 915 DeGuigne Drive Sunnyvale, California. Prepared by Haley and Aldrich, Inc. For Advanced Micro Devices, Inc. February 2014.

Haley and Aldrich, Inc. 2014b. Fourth Five-Year Review Report 915 DeGuigne Drive Sunnyvale, California. Prepared by Haley and Aldrich, Inc. for Advanced Micro Devices, Inc. January 2014.

Haley and Aldrich, Inc. 2014c. 2013 Annual Groundwater Monitoring Report 915 DeGuigne Drive Sunnyvale, California. Prepared by Haley and Aldrich, Inc. for Advanced Micro Devices, Inc. January 2014.

RWQCB. 1991. Order No. 91-101 Site Cleanup Requirements and Recision of Order No. 89-080 for: Advanced Micro Devices 915 DeGuigne Drive Sunnyvale Santa Clara County. Prepared by San Francisco Bay Regional Water Quality Control Board. 19 June 1991.

RWQCB. 2009. Third Five-Year Review Advanced Micro Devices Site 915 DeGuigne Drive Sunnyvale, California. Prepared by San Francisco Bay Regional Water Quality Control Board. September 2009.

Treadwell and Rollo. 2012. Limited Phase II Environmental Site Assessment 915 DeGuigne Drive Sunnyvale, California. Prepared by Treadwell and Rollo for Spansion, LLC. January 2012.

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Appendix B: Press Notice

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PROOF OF PUBLICATION
(2015.5 C.C.P.)
County of Santa Clara
State of California

PUBLIC NOTICE

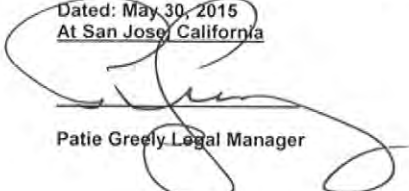
I am a citizen of the United States and a resident of the County aforesaid. I am over the age of 18 years, and not party to or interested in the above entitled matter. I am the principal clerk of the printer of the:

The Sunnyvale Sun, 1095 The Alameda, San Jose, CA 95126 a newspaper of general circulation in the City of Sunnyvale, printed in the City of San Jose, State of California, County of Santa Clara, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Santa Clara, State of California, Case Number CV742853 dated September 22, 1994 that the notice of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said Newspaper and not in any

supplement thereof on the following dates, to wit:
Published 5/30/2014

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated: May 30, 2015
At San Jose, California


Patie Greely Legal Manager

**PUBLIC NOTICE
REGIONAL WATER
BOARD AND EPA BEGIN
FOURTH FIVE-YEAR RE-
VIEW OF CLEANUP AT
THE ADVANCED MICRO
DEVICES SUPERFUND
SITE
915 DeGuigne Drive
Sunnyvale, California**

The California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) and the U.S. Environmental Protection Agency (EPA) are conducting a review of cleanup actions at the Advanced Micro Devices, Inc. (AMD) Superfund Site (Site), located at 915 DeGuigne Drive, in Sunnyvale, California. The review is a routine process under the agreement between AMD and the EPA that will evaluate whether the cleanup actions for the Site remain protective of human health and the environment. The property owner will not participate in the review nor will the review include an evaluation of proposed redevelopment.

This is the fourth Five-Year Review for the AMD Superfund Site at 915 DeGuigne Drive. During this upcoming review process, the Regional Water Board and EPA will study site-specific information for the period between 2009 and 2014, and will evaluate the Site's remedial protectiveness. The Regional Water Board and EPA's project managers conducted facility inspections and will talk with company representatives, other regulatory authorities, and interested members of the public. The methods, findings and conclusions from the review will be documented in the Five-Year Review to be issued by Fall 2014 and will be placed in the information repositories listed below.

The major chemicals of concern are TCE and its breakdown chemicals. AMD removed leaky storage tanks and excavated the surrounding contaminated soil in 1982. Groundwater extraction and treatment was implemented to address groundwater contamination. Long-term groundwater treatment and monitoring are required and an environmental deed restriction was recorded on the property to prohibit extraction and use of groundwater except for remediation and monitoring.

The Regional Water Board and EPA invite the community to learn more about this review process and provide input about progress of the clean-up. One way to get involved is to contact Regional Water Board Project Manager

Max Shahbazian at (510) 622-4824, or mshahbazian@waterboards.ca.gov or Alejandro Diaz, Community Involvement Coordinator, at (415) 972-3242 or diaz.alejandrod@epa.gov. You can obtain further site information at the following Regional Water Board's website at: <http://geotracker.waterboards.ca.gov/search.asp>. Enter the unique Case/Global ID number for this Site, which is SL720051206. Then click on "Report", then on "Geo Report/Site Documents" link under the Electronic Submittals heading.

You may also review the report and other Site documents at the Regional Water Board offices at: 1515 Clay Street, Suite 1400, Oakland, CA 94612 - phone (510) 622-2300. Published 5/30/2014 5195857

*COMMUNITY N

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Appendix C: Interview Forms

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Interview Forms

Five-Year Review Interview Record			
Site:	Advanced Micro Devices, Inc. (Building 915)		EPA ID No: CAT080034234
Interview Type:	Visit		
Location of Visit:	At AMD building- 1 AMD place, Sunnyvale, Ca		
Date:	24 October, 2013	Time:	1000
Interviewer:	Aaron King Ellen Engberg	Title:	Environmental Engineer Geologist USACE USACE
Individual Contacted			
Name:	Peter Bennett	Title:	Lead Hydrogeologist : Organization Haley & Aldrich
Telephone:	(510) 879-4547	Address:	1956 Webster St, Suite 450 Oakland, CA 94612
Name:	Michael Calhoun	Title:	Senior Specialist, Hydrogeologist : Organization Haley & Aldrich
Telephone:	(510) 879-4554	Address:	1956 Webster St, Suite 450 Oakland, CA 94612
Name:	Do Cao	Title:	Site Manager : Organization AMD
Telephone:	(408) 749-6635	Address:	One AMD Place Sunnyvale, CA 98088
Summary of Conversation			
<p>1) What is your overall impression of the project?</p> <p>Project is going well. In O&M mode- This is basically an O&M project.</p> <p>2) Is the remedy functioning as expected? How well is the remedy performing?</p> <p>Remedy- hydraulic containment- functioning as expected. Things are taking longer than expected, as the impact by upgradient COCs is an issue. Concern is for the communities to the north (down gradient) as this is the last property within the greater plume. 60 GPM is containing the plume, essentially shoring up the edge of the plume. A 2007 investigation to target expediting cleanup found that this shoring was in fact working. The building sumps are acting as extraction wells, capturing the Mohawk plume. Unless land use happens, those sumps will continue to run, and they can't really change the remedy.</p> <p>3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?</p> <p>Trends have decreased compared to early dates, they are pretty stable now.</p> <p>4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.</p> <p>Yes. FSI (field solutions, Inc., subcontractor for O&M) is continuously running 3 GAC vessels onsite. Discharge is under permit. H&A does reports.</p>			

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.

Yes. Changed from Air Stripper to GAC, summer of 2012. System was used for Philips offsite too, but they lost too much flow when Philips moved. More efficient now to change to GAC

6) What are the annual operating costs for your organization's involvement with the site?

Contractor will supply #s later- estimated at ~\$100k/year. This is for carbon change outs, O&M oversight, biweekly sight visits, recording, and reports, annual reports, and the water bill.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.

Unexpected- exceedance last year in DCE- Added a carbon vessel even though calculations suggested that is shouldn't have been needed. They have switched to using virgin carbon now instead of re-used.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Changing from air stripper to carbon unit- Air stripper still there as a backup.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

TCE & VI. These are below levels of concern here.

10) Do you have any comments, suggestions, or recommendations regarding the project?

Difficult due to building sumps and location- Downgradient at the edge of plume, and at the edge of a residential area. Not getting maximum removal, just hydraulic containment.

Appendix D: Site Inspection Checklist

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Site Inspection Checklist

I. SITE INFORMATION										
Site name: Advanced Micro Devices, Inc. (Building 915)	Date of inspection: 10/24/2013									
Location: Sunnyvale, CA	EPA ID: CAT080034234									
Agency, office, or company leading the five-year review: State of California	Weather/temperature: 60°F, overcast									
Remedy Includes: (Check all that apply) <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"><input type="checkbox"/> Landfill cover/containment</div> <div style="width: 50%;"><input type="checkbox"/> Monitored natural attenuation</div> <div style="width: 50%;"><input type="checkbox"/> Access controls</div> <div style="width: 50%;"><input checked="" type="checkbox"/> Groundwater containment</div> <div style="width: 50%;"><input checked="" type="checkbox"/> Institutional controls</div> <div style="width: 50%;"><input type="checkbox"/> Vertical barrier walls</div> <div style="width: 50%;"><input checked="" type="checkbox"/> Groundwater pump and treatment</div> <div style="width: 50%;"><input type="checkbox"/> Surface water collection and treatment</div> <div style="width: 50%;"><input checked="" type="checkbox"/> Other: <i>Groundwater monitoring</i></div> </div>										
Attachments: <input type="checkbox"/> Inspection team roster attached <input type="checkbox"/> Site map attached										
II. INTERVIEWS (Check all that apply)										
1. O&M site manager and staff _____ <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%; text-align: center;">Name</th> <th style="width: 20%; text-align: center;">Title</th> <th style="width: 20%; text-align: center;">Date</th> </tr> </thead> <tbody> <tr> <td colspan="3"> Interviewed <input type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. _____ </td> </tr> <tr> <td colspan="3"> Problems, suggestions; <input checked="" type="checkbox"/> Report attached; See Appendix C </td> </tr> </tbody> </table>		Name	Title	Date	Interviewed <input type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. _____			Problems, suggestions; <input checked="" type="checkbox"/> Report attached; See Appendix C		
Name	Title	Date								
Interviewed <input type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. _____										
Problems, suggestions; <input checked="" type="checkbox"/> Report attached; See Appendix C										
2. O&M staff <u>Not applicable</u>										
3. Local regulatory authorities and response agencies (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply. <u>Max Shahbazian is the RWQCB representative. RWQCB is the lead agency for the remedial actions and oversight, but was not interviewed.</u>										
4. Other interviews (optional) <input type="checkbox"/> Report attached.										
NA										

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1.	O&M Documents		
	<input checked="" type="checkbox"/> O&M manual	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
	<input checked="" type="checkbox"/> As-built drawings	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
	<input checked="" type="checkbox"/> Maintenance logs	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
<u>Remarks:</u> Documents are not kept on site, but remediation contractors and Regional Water Quality Control Board have access to up to date copies of all required documents, not just those in this section.			
2.	<input checked="" type="checkbox"/> Site-Specific Health and Safety Plan	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
	<input checked="" type="checkbox"/> Contingency plan/emergency response plan	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
<u>Remarks:</u> Contingency plan is part of the Health and Safety Plan			
3.	O&M and OSHA Training Records	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
<u>Remarks:</u> OSHA training records available at contractor offices			
4.	Permits and Service Agreements		
	<input checked="" type="checkbox"/> Air discharge permit	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
	<input checked="" type="checkbox"/> Effluent discharge	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
	<input type="checkbox"/> Waste disposal, POTW	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Other permits_____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
<u>Remarks:</u>			
5.	Gas Generation Records	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
<u>Remarks:</u>			
6.	Settlement Monument Records	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
<u>Remarks:</u>			
7.	Groundwater Monitoring Records	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
<u>Remarks:</u> Haley and Aldrich submits annual groundwater monitoring reports			
8.	Leachate Extraction Records	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
<u>Remarks:</u>			

9.	Discharge Compliance Records	<input checked="" type="checkbox"/> Air	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
		<input checked="" type="checkbox"/> Water (effluent)	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<u>Remarks:</u>				

10.	Daily Access/Security Logs	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<u>Remarks:</u> Kept by Spansion (current property owner)			

IV. O&M COSTS

1.	O&M Organization	<input type="checkbox"/> State in-house	<input type="checkbox"/> Contractor for State	
		<input type="checkbox"/> PRP in-house	<input checked="" type="checkbox"/> Contractor for PRP	
		<input type="checkbox"/> Federal Facility in-house	<input type="checkbox"/> Contractor for Federal Facility	
	<input type="checkbox"/> Other			

2.	O&M Cost Records	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date													
	<input checked="" type="checkbox"/> Funding mechanism/agreement in place															
	Original O&M cost estimate _____ <input type="checkbox"/> Breakdown attached															
Total estimated annual cost for review period:																
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">Year</th> <th style="width: 80%;">Annual Cost</th> </tr> <tr> <td>2009</td> <td>\$63,000</td> </tr> <tr> <td>2010</td> <td>\$72,000</td> </tr> <tr> <td>2011</td> <td>\$144,000</td> </tr> <tr> <td>2012</td> <td>\$189,000</td> </tr> <tr> <td>2013</td> <td>\$253,000</td> </tr> </table>					Year	Annual Cost	2009	\$63,000	2010	\$72,000	2011	\$144,000	2012	\$189,000	2013	\$253,000
Year	Annual Cost															
2009	\$63,000															
2010	\$72,000															
2011	\$144,000															
2012	\$189,000															
2013	\$253,000															

3.	Unanticipated or Unusually High O&M Costs During Review Period	<u>Describe costs and reasons:</u> Annual costs have increased substantially over the review period, but an itemized breakdown was not provided for this review (i.e., the reason for the cost increases is not known as of this writing).
----	---	--

V. ACCESS AND INSTITUTIONAL CONTROLS	<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A
---	--	------------------------------

A. Fencing

1.	Fencing damaged	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Gates secured	<input type="checkbox"/> N/A
<u>Remarks:</u> Access to extraction and treatment system only through Spansion security gates and checkpoints; Fencing in good condition				
B. Other Access Restrictions				
1.	Signs and other security measures	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A	
<u>Remarks:</u> Signs posted on fences that enclose treatment system components (inside of security checkpoints)				
C. Institutional Controls (ICs)				
1.	Implementation and enforcement			
	Site conditions imply ICs not properly implemented	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> N/A
	Site conditions imply ICs not being fully enforced	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> N/A
	Reporting is up-to-date	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
	Reports are verified by the lead agency	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
	Specific requirements in deed or decision documents have been met	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
	Violations have been reported	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> N/A
	Other problems or suggestions: <input type="checkbox"/> Report attached			
2.	Adequacy	<input checked="" type="checkbox"/> ICs are adequate	<input type="checkbox"/> ICs are inadequate	<input type="checkbox"/> N/A
<u>Remarks:</u>				
D. General				
1.	Vandalism/trespassing	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> No vandalism evident	
<u>Remarks:</u>				
2.	Land use changes on site	<input checked="" type="checkbox"/> N/A		
<u>Remarks:</u>				

3.	Land use changes off site	<input checked="" type="checkbox"/> N/A		
<u>Remarks:</u>				
VI. GENERAL SITE CONDITIONS				
A. Roads <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A				
1.	Roads damaged	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Roads adequate	<input type="checkbox"/> N/A
<u>Remarks:</u>				
B. Other Site Conditions				
<u>Remarks:</u> Northern edge of an industrial park; residential to the north (downgradient)				
VII. LANDFILL COVERS <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A				
VIII. VERTICAL BARRIER WALLS <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A				
IX. GROUNDWATER/SURFACE WATER REMEDIES <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A				
A. Groundwater Extraction Wells, Pumps, and Pipelines <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A				
1.	Pumps, Wellhead Plumbing, and Electrical			
<input checked="" type="checkbox"/> Good condition <input checked="" type="checkbox"/> All required wells properly operating <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A				
<u>Remarks:</u>				
2.	Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances			
<input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance				
<u>Remarks:</u>				
3.	Spare Parts and Equipment			
<input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Good condition <input type="checkbox"/> Requires upgrade <input type="checkbox"/> Needs to be provided				
<u>Remarks:</u>				
B. Surface Water Collection Structures, Pumps, and Pipelines <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A				
C. Treatment System <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A				

1.	Treatment Train (Check components that apply)
<div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> Metals removal <input type="checkbox"/> Oil/water separation <input type="checkbox"/> Bioremediation </div> <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Air stripping (now a backup) <input checked="" type="checkbox"/> Carbon adsorbers </div> <div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> Filters </div> <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Additive (<i>e.g.</i>, chelation agent, flocculent): scale inhibitor is added before the air strippers when in use </div> <div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> Others </div> <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance </div> <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Sampling ports properly marked and functional </div> <div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> Sampling/maintenance log displayed and up to date </div> <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Equipment properly identified </div> <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Quantity of groundwater treated annually: 24,000,000 – 37,000,000 gallons </div> <div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> Quantity of surface water treated annually_____ </div> <div style="margin-top: 5px;"> <u>Remarks:</u> </div>	
2.	Electrical Enclosures and Panels (properly rated and functional)
<div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> N/A <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance </div> <div style="margin-top: 5px;"> <u>Remarks:</u> </div>	
3.	Tanks, Vaults, Storage Vessels
<div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> N/A <input checked="" type="checkbox"/> Good condition <input checked="" type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs Maintenance </div> <div style="margin-top: 5px;"> <u>Remarks:</u> </div>	
4.	Discharge Structure and Appurtenances
<div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> N/A <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance </div> <div style="margin-top: 5px;"> <u>Remarks:</u> </div>	

5.	Treatment Building(s)	<input checked="" type="checkbox"/> N/A <input type="checkbox"/> Good condition (esp. roof and doorways) <input type="checkbox"/> Needs repair <input type="checkbox"/> Chemicals and equipment properly stored <u>Remarks:</u>
6.	Monitoring Wells (pump and treatment remedy)	<input checked="" type="checkbox"/> Properly secured/locked <input checked="" type="checkbox"/> Functioning <input checked="" type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> Good condition <input checked="" type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A <u>Remarks:</u> Contractor has been able to locate all wells for sampling
D. Monitoring Data		
1.	Monitoring Data	<input checked="" type="checkbox"/> Is routinely submitted on time <input checked="" type="checkbox"/> Is of acceptable quality
2.	Monitoring data suggests:	<input checked="" type="checkbox"/> Groundwater plume is effectively contained <input type="checkbox"/> Contaminant concentrations are declining
D. Monitored Natural Attenuation		
1.	Monitoring Wells (natural attenuation remedy)	<input checked="" type="checkbox"/> Properly secured/locked <input checked="" type="checkbox"/> Functioning <input checked="" type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> Good condition <input checked="" type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A <u>Remarks:</u> MNA is not a part of the remedy at this site
X. OTHER REMEDIES		
NA		
XI. OVERALL OBSERVATIONS		
A. Implementation of the Remedy		
<p>Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).</p> <p><u>The remedy is currently operating to contain any on-site contamination, but also any contamination that originates from upgradient (off-site) sources. The remedy was designed to include air stripping, but now only includes GAC treatment (with RWQCB approval).</u></p>		
B. Adequacy of O&M		

	<p>Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.</p> <p><u>There are no issues related to O&M procedures.</u></p>
C.	Early Indicators of Potential Remedy Problems
	<p>Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.</p> <p><u>There have been no changes in the cost or scope of O&M and there has not been a high frequency of unscheduled repairs. Upgradient (off-site) contamination continues to migrate onto the AMD 915 Site.</u></p>
D.	Opportunities for Optimization
	<p>Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.</p> <p><u>Air stripper operations have ceased, but the air strippers are still functional and are used as a backup. Three activated carbon units are now used, which do not use as much energy.</u></p> <p><u>The sampling contractor should consider using passive sampling technologies such as the HydraSleeve or polyethylene (or passive) diffusion bags. These passive technologies are proven, easy to use, inexpensive, can sample discrete well intervals, and do not require purging the well (which may result in substantially less investigation-derived waste and associated analysis and disposal costs).</u></p>

Appendix E: Photographs from Site Inspection Visit

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Photographs from Site Inspection Visit



Photo 1. Air Strippers (currently the backup system)



Photo 2. Fencing and signage near air strippers



Photo 3. GAC Vessels currently in use



Photo 4. GAC vessels with labels



Photo 5. Holding tanks (foreground and background)



Photo 6. Basement Sump 6 (BS-6); run as necessary



Photo 7. Fencing and signage around the carbon vessels and holding tanks



Photo 8. Extraction Well EW-5 (12-13 gpm, A-B1 zone)



Photo 9. Extraction Well EW-7 (1.5 gpm, B2-zone)

Appendix F: Restrictive Covenant

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Restrictive Covenant

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1442752
FILED FOR RECORD
AT REQUEST OF

GRANTOR

AUG 7 8 15 AM '92

SAN FRANCISCO COUNTY
CALIFORNIA
RECORDS

Recording Requested By:

Advanced Micro Devices, Inc.

When Recorded, Mail to:

Advanced Micro Devices, Inc.
901 Thompson Place, Mail Stop 68
P.O. Box 3453
Sunnyvale, California 94088-3000
Attn: Hollis M. Fitzgerald, Esq.,

REC FEE	9
RMP	7
MICRO	7
ATCP	6
LIEN	
BMFF	
3 PCOR	

With a certified copy to:

California Regional Water
Quality Control Board
San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, California 94612
Attn: Steven R. Ritchie, Executive Officer

**COVENANT AND AGREEMENT TO RESTRICT USE OF PROPERTY AT
915 DeGUIGNE DRIVE
SUNNYVALE, CALIFORNIA**

This Covenant and Agreement ("Covenant") is made on the
7th day of August, 1992 by and between
Advanced Micro Devices, Inc., a California corporation
("Covenantor"), and the California Regional Water Quality Control
Board, San Francisco Bay Region ("Regional Board").

R E C I T A L S

- A. Covenantor is the owner of that certain parcel of real property located at 915 DeGuigne Drive, City of Sunnyvale, County of Santa Clara, State of California and more particularly described in Exhibit "A", attached hereto and incorporated herein by this reference (the "Property").
- B. Organic and inorganic chemicals have been detected in soil and groundwater at the Property. The Regional Board has issued Order 91-101, which provides for investigation of conditions at the Property and for remedial action.
- C. Covenantor desires and intends that in order to protect the present or future public health and safety, the Property shall be used in such a manner as to avoid potential harm to persons or property which may result from contamination which has been detected in groundwater beneath the Property.

NOW, THEREFORE, Covenantor, for itself, its successors and assigns, hereby declares and agrees as follows:

ARTICLE I

DEFINITIONS

- 1.01 Occupant. "Occupant" shall mean any Person other than an Owner entitled by leasehold or other legal relationship to the exclusive right to occupy any portion of the Property.
- 1.02 Owner. "Owner" shall mean the Covenantor or its successors in interest, including heirs and assigns, who hold fee title to all or any portion of the Property.
- 1.03 Regional Board. "Regional Board" shall mean the California Regional Water Quality Control Board, San Francisco Bay Region, and shall include its successor agencies, if any.
- 1.04 Upper Water-Bearing Aquifer. "Upper Water-Bearing Aquifer" shall mean the potential water-bearing units occurring from ground surface to _____ feet below ground surface.

ARTICLE II

GENERAL PROVISIONS

- 2.01 Provisions to Run With the Land. The covenants, conditions and restrictions contained in this Covenant shall run with the land, and pass with each and every portion of the Property, and shall apply to and bind the respective successors-in-interest thereof. Each and all of the covenants, conditions, and restrictions are imposed upon the entire Property unless expressly stated to be applicable only to a specific portion of the Property. The covenants, conditions, and restrictions set out herein shall be incorporated by reference in each and all deeds and leases of appropriate portions of the Property.
- 2.02 Acceptance. Every Owner or Occupant, by acceptance of a deed conveying title to all or any portion of the subject Property, or by execution of a contract to purchase thereof, or by the acceptance of a lease, easement or license therefor, or by the taking of possession thereof, whether from Covenantor or any subsequent Owner or Occupant, shall accept such deed, contract, lease, easement, license or possession upon and subject to each and all of the covenants, conditions and restrictions contained in this Covenant, and by such acceptance shall for itself, its heirs, successors and assigns, covenant, consent and agree to and with Covenantor and the Regional Board, their heirs, successors and assigns, to keep, observe, comply with and perform the covenants, conditions and restrictions contained herein, whether or not any reference to this Covenant is contained in the instrument by which such person or entity acquired its interest in the subject Property. Every person or entity who now or hereafter owns or acquires any right, title or interest in and to any portion of the Property is and shall be conclusively deemed to have consented and agreed to the covenants, conditions and

restrictions contained herein, whether or not any reference to this Covenant is contained in the instrument by which such person or entity acquired an interest in the Property or whether or not such person or entity obtained such interest by operation of law.

ARTICLE III

DEVELOPMENT, USE, AND CONVEYANCE OF THE PROPERTY

3.01 Restrictions on Use. Until such restrictions are terminated in accordance with Section 4.02 hereof, Covenantor promises to restrict the use of the Property as follows:

- a. The Owner or Occupant of the Property will not use or cause to be used the Upper Water-Bearing Aquifers as a source and/or supply of drinking water.
- b. The Owner or Occupant of the Property will not drill, construct, install, inspect, maintain, replace, remove, use, or operate any groundwater extraction wells or groundwater monitoring wells on the Property; provided, however, that any such wells may be located on or operated on the Property as may be necessary to investigate, characterize and remediate groundwater contamination pursuant to any order of any local, state or federal governmental or regulatory agency.

3.02 Conveyance of Property. The Owner or Owners shall provide a thirty (30) day advance notice to the Regional Board of any sale, lease, or other conveyance of the Property or an interest in the Property to a third person. The Regional Board shall not, by reason of the Covenant, have authority to approve, disapprove, or otherwise affect any sale, lease, or other conveyance of the Property except as otherwise provided by law or by administrative order.

3.03 Notice in Agreements. All Owners and Occupants shall execute a written instrument which shall accompany each purchase, lease, sublease, or rental agreement relating to the Property. The instrument shall contain the following statement:

"The groundwater and subsurface soil beneath the Property described herein contain hazardous substances. The California Regional Water Quality Control Board has determined that metals and volatile organic chemicals are "chemicals of concern" with regard to groundwater, and that volatile organic chemicals are "chemicals of concern" with regard to soils. Pursuant to applicable provisions of Chapter 6.8 of Division 20 of the California Health and Safety Code and Chapter 5 of Division 2 of the California Water Code, the California Regional Water Quality Control Board is authorized to impose upon the Property and its owner(s) or occupant(s) appropriate conditions, restrictions and requirements necessary to control and/or remediate

contamination detected at the Property. Additional information may be obtained by reviewing the files of the California Regional Water Quality Control Board, San Francisco Bay Region, or its successor agency. This statement is not a declaration that a hazard exists."

3.04 **Enforcement.** Failure of the Owner to comply with any of the requirements set forth in paragraph 3.01 shall be grounds for the Regional Board, by reason of the Covenant, to require that the Owner modify or remove any improvements constructed in violation of that paragraph and/or to cease activities in violation of that paragraph. Violation of the Covenant shall be grounds for the Regional Board to pursue legal actions against the Owner to the extent provided by law.

ARTICLE IV

VARIANCE AND TERMINATION

4.01 **Variance.** Any Owner or, with the Owner's consent, any Occupant of the Property or any portion thereof may apply to the Regional Board for a written variance from the provisions of this Covenant. Any Occupant making such application shall concurrently provide to all Owners a complete copy of such application. A variance shall be granted if the Regional Board determines that such variance will not (1) create or increase a significant present or future hazard to public health; (2) significantly diminish the ability to mitigate any significant potential or actual hazard to public health; or (3) cause a long-term increase in the number of humans or animals exposed to significant hazards which affect the health, well-being or safety of the public.

4.02 **Termination.** Any Owner or, with the Owner's consent, any Occupant of the Property or a portion thereof may apply to the Regional Board for termination of all or any of the provisions of this Covenant as they apply to all or any portion of the Property. Any Occupant making such application for termination shall concurrently provide to all Owners a complete copy of such application. The Regional Board shall terminate the provisions of this Covenant if (1) groundwater cleanup standards have been achieved and pollutant levels have stabilized in onsite aquifers, or (2) if conditions at the Property are otherwise found not to present a significant existing or potential hazard to present or future public health or safety. In determining whether conditions at the Property have ceased to present a significant existing or potential hazard to present or future public health or safety, the Regional Board shall give consideration to any or all of the following: (a) whether the contamination detected in the groundwater has been altered or removed in a manner which precludes any significant existing or potential hazard to present or future public health; (b) whether new scientific evidence has become available since the imposition of the restriction on the

Property, concerning (i) the nature of the contaminant(s) which caused the Property to be restricted, or (ii) the geology or other physical environmental characteristics of the Property; or (c) other factors that indicate that the Property does not present a significant current or future hazard to human health or safety.

4.03 Term. Unless terminated in accordance with paragraph 4.02 above, by law or otherwise, this Covenant shall continue in effect in perpetuity.

ARTICLE V

MISCELLANEOUS

5.01 No Dedication Intended. Nothing set forth herein shall be construed to be a gift or dedication, or offer of a gift or dedication, of the Property or any portion thereof to the general public or for any purpose whatsoever.

5.02 Notices. Whenever any person gives or serves any notice, demand, or other communication with respect to this Covenant, each such notice, demand, or other communication shall be in writing and shall be deemed effective (1) when delivered, if personally delivered to the person being served or to an officer of a corporate party being served or official of a government agency being served, or (2) three (3) business days after deposit in the mail if mailed by United States mail, postage paid certified, return-receipt requested:

TO: Advanced Micro Devices, Inc.
901 Thompson Place
P.O. Box 3453
Sunnyvale, CA 94088-3000
Attn: General Counsel

COPY TO: California Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street
Oakland, CA 94612

5.03 Partial Invalidity. If any provision contained in this Covenant is determined to be invalid for any reason, the remaining portion(s) of this Covenant shall remain in full force and effect as if such provision had not been included herein.

5.04 Headings. Headings at the beginning of each numbered article or paragraph of this Covenant are solely for the convenience of the parties and are not a part of the Covenant.

5.05 Recordation. This Covenant shall be executed by the Covenantor and by the Regional Board. This Covenant shall be recorded by the Covenantor in the County of Santa Clara within ten (10) days of the date of execution.

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5.06 Counterparts. This Covenant may be executed in counterparts, each of which shall be deemed to be an original but which, taken together, shall constitute one and the same instrument.

5.07 References. All references to Code sections include successor provisions.

IN WITNESS WHEREOF, the parties execute this Covenant as of the date set forth above.

COVENANTOR
ADVANCED MICRO DEVICES, INC.

By: [Signature]

Title: Vice President

Date: 8/3/92

REGIONAL WATER QUALITY CONTROL
BOARD

By: [Signature]

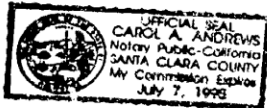
Title: Executive Director

Date: 8/2/92

STATE OF CALIFORNIA)
COUNTY OF Santa Clara)

On August 3, 1982, before me, the undersigned, a Notary Public in and for said state, personally appeared Thomas H. Bopp, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as President of the corporation that executed the within instrument, and acknowledged to me that such corporation executed the same pursuant to its bylaws or a resolution of its board of directors.

WITNESS my hand and official seal.

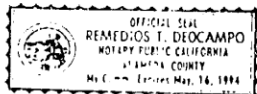


Carol A. Andrews
Notary Public in and for said
County and State

STATE OF CALIFORNIA)
COUNTY OF Alameda)

On August 3, 1982, before me, the undersigned, a Notary Public in and for said state, personally appeared STEVEN R. RITCHIE, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed the within instrument as Executive Director of the Regional Water Quality Control Board, San Francisco Bay Region, the agency that executed the within instrument, and acknowledged to me that such agency executed the same.

WITNESS my hand and official seal.



Remedios T. Diocampo
Notary Public in and for said
County and State

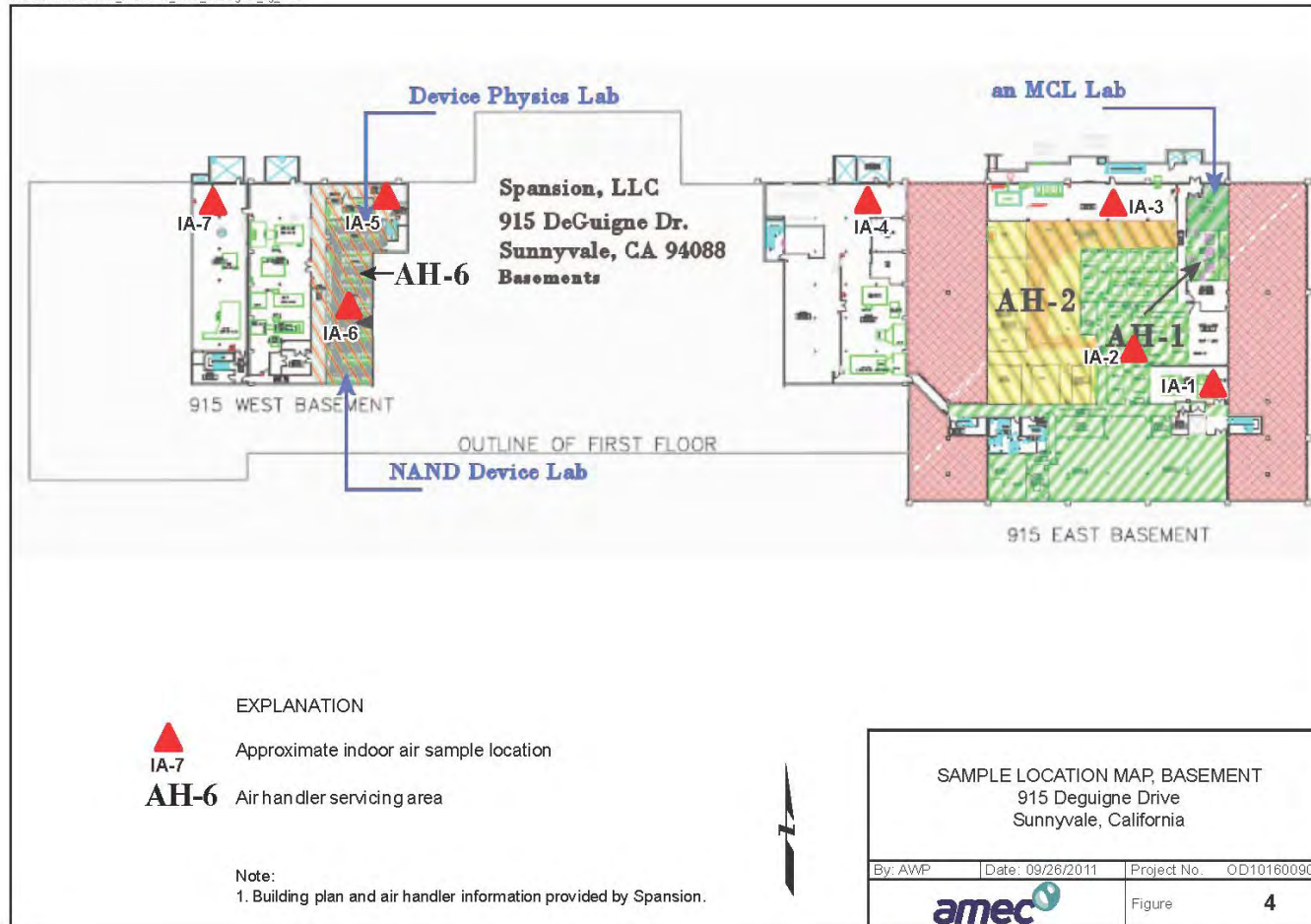
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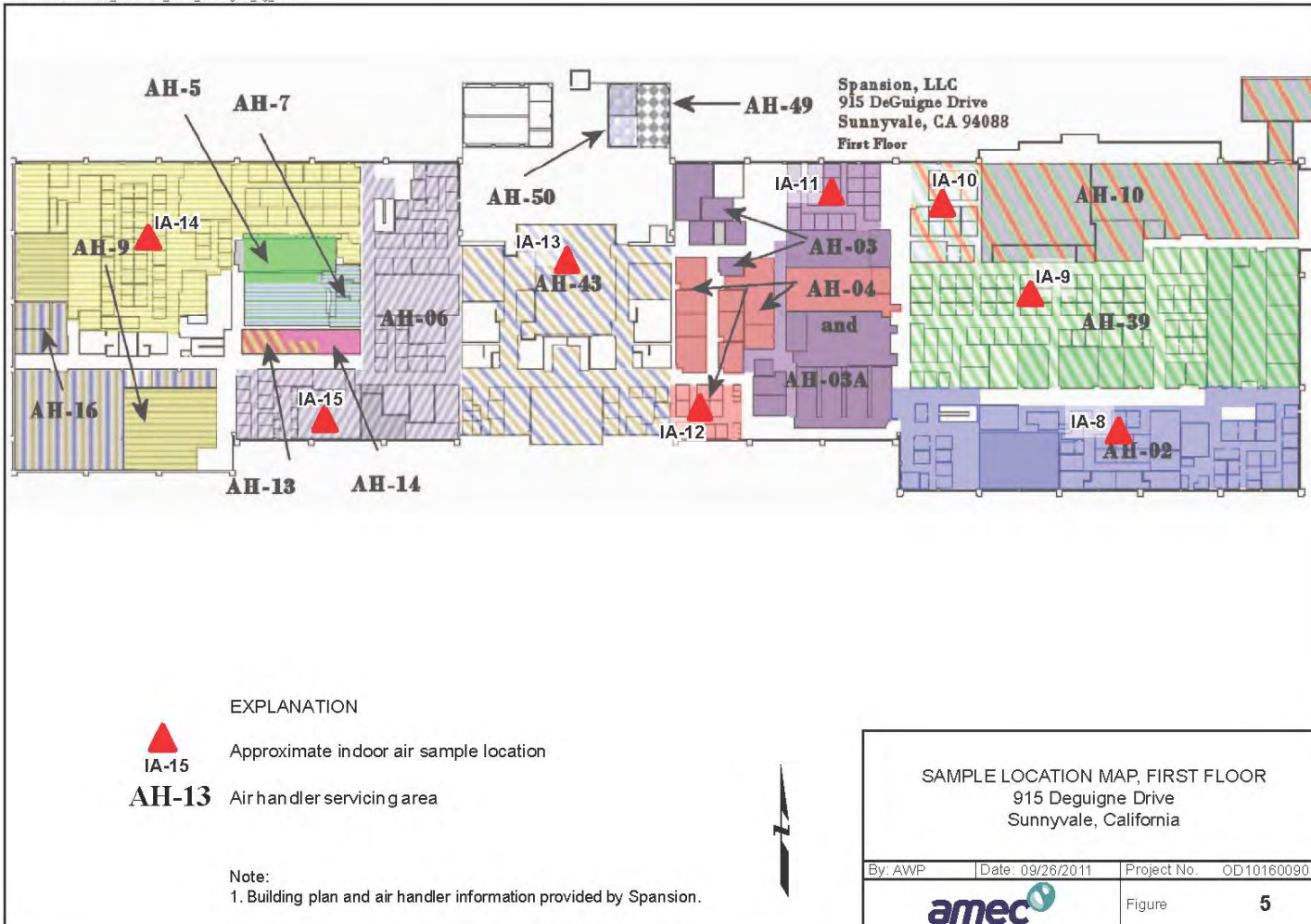
Appendix G: August 2011 Indoor Air Sampling Locations

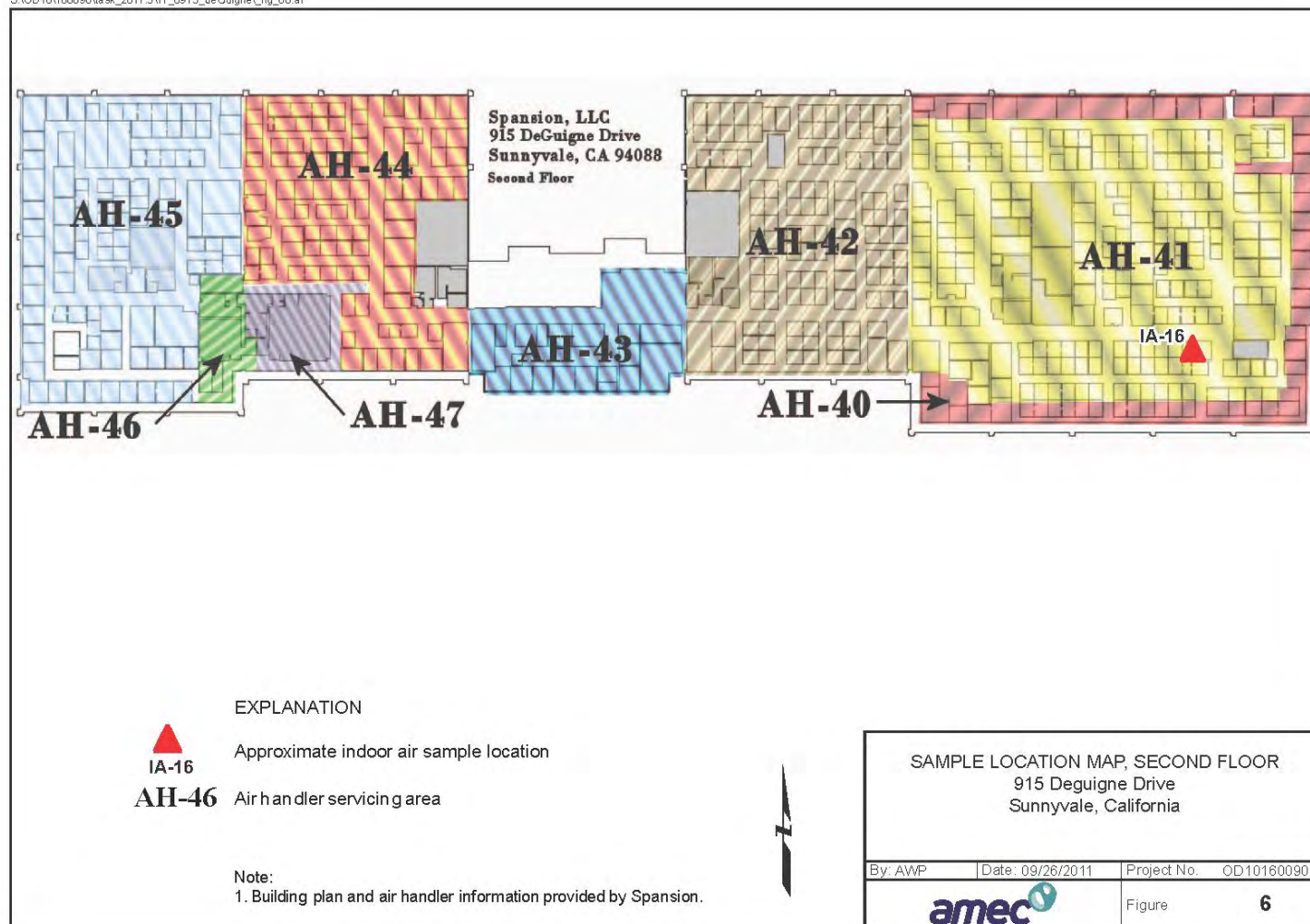
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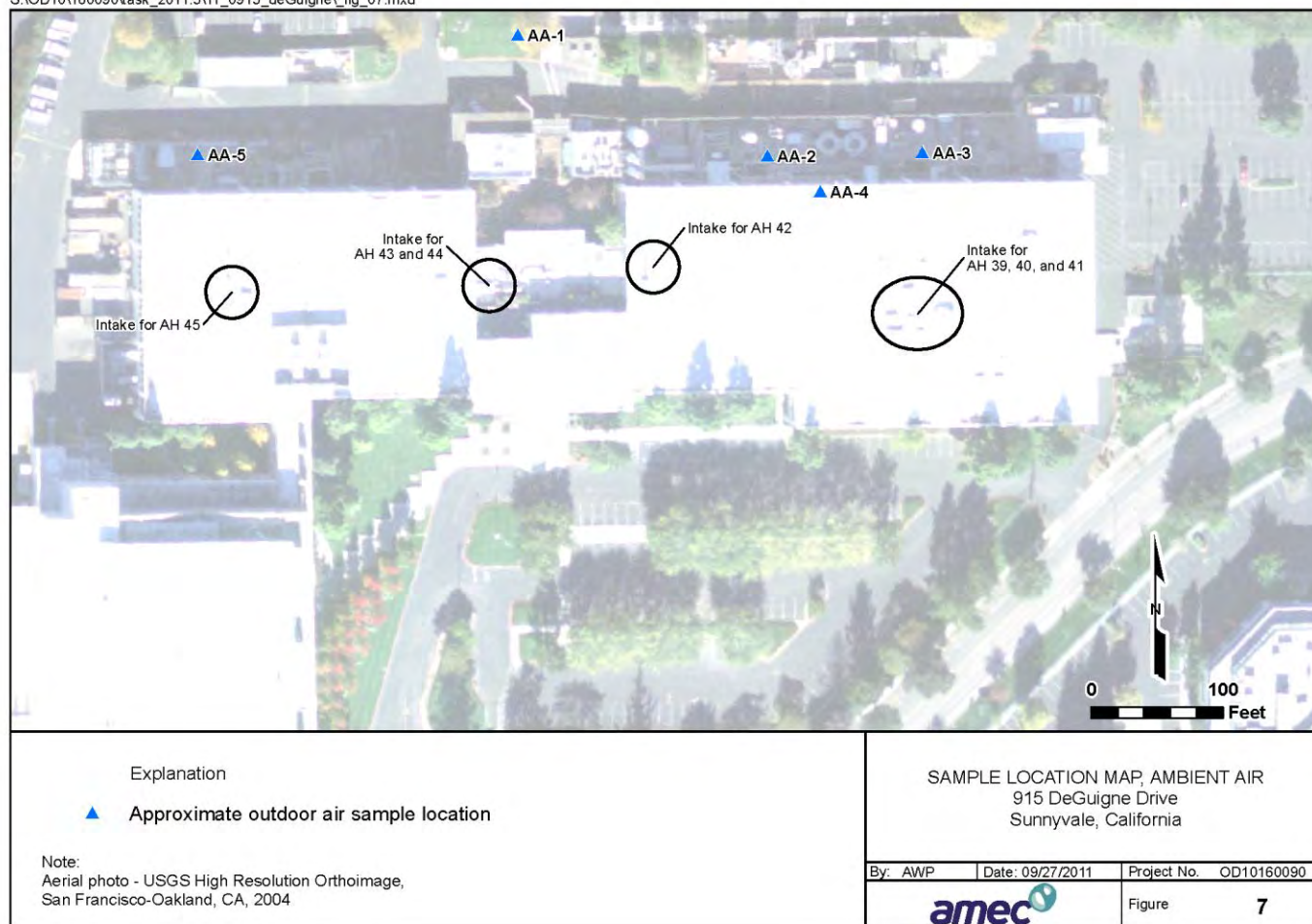
August 2011 Indoor Air Sampling Locations

S:\OD10\160090\ask_2011_3\1_0913_deGugne\fig_04.ai









Appendix H: TCE and cis-1,2-DCE Plots

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TCE and cis-1,2-DCE Plots

